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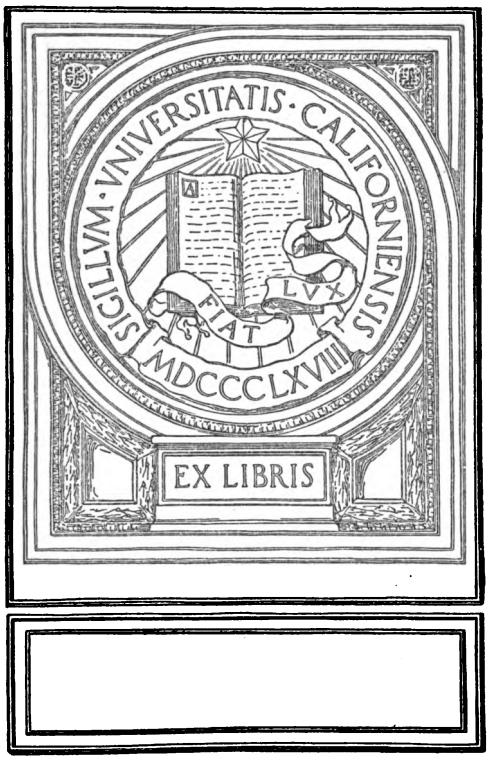

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BRITAIN'S GLORIOUS NAVY

Edited by

ADMIRAL SIR REGINALD H. S. BACON
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With a Foreword by

ADMIRAL SIR EDWARD R. G. R. EVANS
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FOREWORD

BY ADMIRAL SIR E. R. G. R. EVANS

K.C.B., D.S.O., LL.D.

IN the midst of the Second World War, Britain turned her attention to raising sums of money by means of Warship Weeks. Every city, every borough, every village, and every little home showed its mettle by subscribing for Victory and Freedom. The "targets" aimed at were on an ambitious scale. In spite of the heaviest taxes and burdens that the nation had ever been called upon to bear, cities provided battleships or aircraft carriers, towns subscribed enough to purchase cruisers, submarine depot ships, or other expensive craft, and even small villages managed to purchase high-speed motor launches.

How has this all been possible? It is because our nation loves its Navy; the Naval Service has always cast a glamour over our island race. The history of Britain has continually stressed the vital importance of sea power to an island nation. Since Tudor times, Britain has relied upon her seamen for protection and the Royal Navy has proved a sure shield.

Yet Britain is a country with a short memory; our nationals find it difficult to hate, and our history shows that our rulers, after victory, have almost always allowed our fighting Services to lapse and decay. Remember the time when Van Tromp, the Dutchman, sailed into the Downs and destroyed seventy ships in the presence of our own fleet. We were humiliated, our ships being powerless to act through neglect and unpreparedness.

Remember the words attributed to Nelson:—

"Our God and the sailor we adore,
In times of danger, not before;
The danger past, both are requited;
God is forgotten, and the sailor slighted."

However, the results of Warship Weeks show that we as a nation sincerely believe in Victory, and in the young valiants of the Royal Navy who, with their big ships and little ships, are doing so much to achieve it. We likewise believe that the best help we can give to our

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incomparable mercantile marine is by building them warships. The convoys facing the hazards of bringing home the Nation's food supply need all the protection we can afford them.

I know the Navy and the Sea Services as well as most men living. I have sailed with the Navy throughout the Seven Seas, including the Arctic and the Antarctic. I have sailed under men like Captain Scott who thought that a cruel death out in the snowy wild of the Great Ice Barrier, "was better than lounging in too great comfort at home." I have served under Admiral Bacon, a stern, just, great man, a man whose scientific attainments are equal to those of the best in the land. When I was given the chance to write a foreword to a volume prepared by him my heart leapt with joy. It seemed to me that, in adding one little link to this book of our great Sea Service, I had just cause for pride.

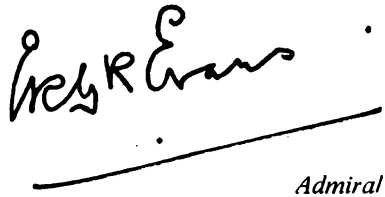
In this war, as in all previous wars, the Navy has necessarily had its successes and its set-backs; I will not call them defeats, because history has shown that the Navy always puts the final letter, the "Y" in the word "VICTORY."

Do you remember, in 1914, the Battle of Coronel, when the bigger ships, the *Scharnhorst* and the *Gneisenau*, the *Dresden*, the *Leipzig* and the *Nürnberg*, sank the obsolete H.M.S. *Good Hope* and *Monmouth*? The little H.M.S. *Glasgow* escaped to tell the tale, and brought our bigger ships with bigger guns to round up and destroy in turn Admiral Von Spee's famous *Scharnhorst* and *Gneisenau* and their consorts at the Falkland Islands Battle. I think of this as "The Battle of Retribution," and a similar fate will, I hope, befall those ships which came through the Channel in 1942 just at the time when the armed forces of Britain were busy in the Straits of Malacca and dispersed over many other theatres of war.

Look what happened when three small cruisers in the South Atlantic hunted down and sank the *Graf Spee* — that "unsinkable" pocket battleship—and remember how the *Bismarck* met her doom whilst limping back from battle to traitor-controlled Brest. Think of what Admiral Cunningham's men, those hearts of steel, did to Mussolini's stab-in-the-back fleet in the Mediterranean, when half his warships were hammered and sunk off Cape Matapan, without the loss of half a dozen of our seamen. Again and again the tale is told. What more can we ask, what more do we demand of the Royal Navy?

And now let me add my tribute to the merchant seaman, be he captain, engineer, bo'sun, able seaman, greaser, steward, fireman, or first-voyage apprentice. Let me bring home to you something that can never be driven in too strongly—the debt that we can never repay, that we owe to these steadfast, fearless sailormen whose convoys of iron tramps maintain their ceaseless service. I, for one, shall never forget the time I spent with the convoys, the whiffs of smoke from their funnels, the phosphorescent wakes, the thud-thud of their heavy propellers, the swish of salt spray in the sweltering heat of the tropics, the hiss of the Arctic blizzard, the song of the breeze in the Trade Winds, the howl of the Atlantic gale.

Now start your voyage, you book of the sea! Go out to the youth of our Nation; to the people, young and old, of Britain and her Allies. Bind them all into a single bond of admiration and love for those "that go down to the sea in ships."



Admiral

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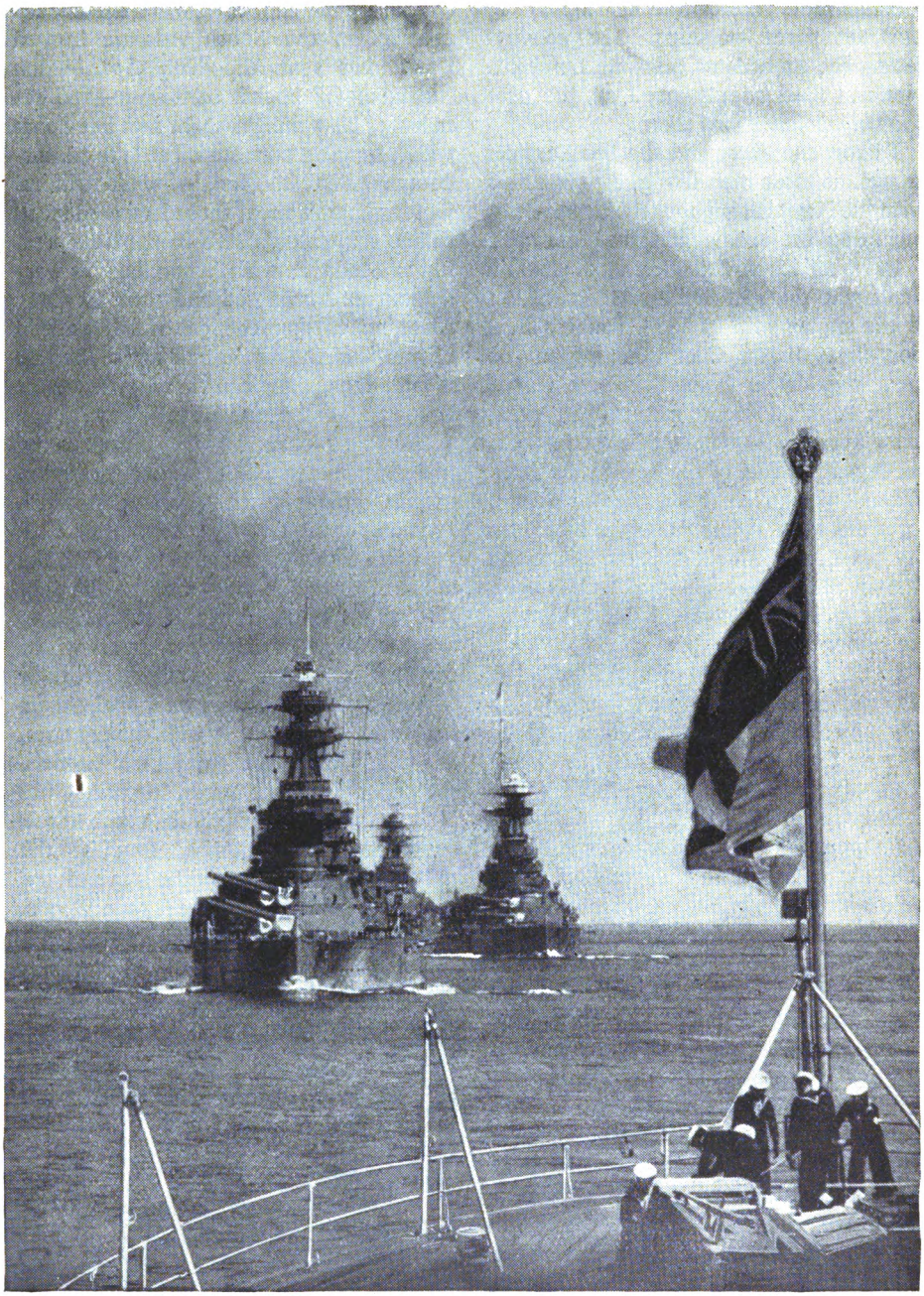

BATTLESHIPS OF THE ROYAL NAVY

Capital ships are the most powerful ships in a navy. Upon their number the comparative naval strength of nations depends. They are the deciding factor in any fleet action at sea

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INTRODUCTION

BY ADMIRAL SIR REGINALD H. S. BACON

K.C.B., K.C.V.O., D.S.O.

CHANGES and progress in the British Navy are constantly taking place. In wartime new problems arise, new classes of ships come into being, new weapons are brought into service, new methods are devised and adequate solutions evolved. Many of these are considered to be sufficiently important to be kept secret, but there are some that are not confidential. Description and explanation of these interesting matters have been prepared specially in this book for those not intimately connected with the Navy.

The book is divided into three parts: Personnel, Materiel and Operations. These classifications can only be considered to be approximate, for questions of personnel are bound to invade matters of ship design and armament, nor can design be divorced from practical use. It is impossible to separate arbitrarily the man from the material he controls, in a service where they are so intimately interwoven as in the Royal Navy.

The three parts are subdivided into eighteen chapters, each written by an expert on the subject with which he deals, or by one who has made a close study of a particular theme.

In Chapter 1, Admiral Sir Herbert W. Richmond, K.C.B., D.C.L., M.A., who for many years served with distinction in the Navy and is now Lecturer on Naval and Imperial History at Cambridge University, deals with our traditions and the morale resulting from them, and the effect our naval attitude had on international events in Europe during the last fifty years.

Conditions of life on board ship have improved with the betterment of social services ashore. In Chapter 2, Captain Ritchie, C.V.O., better known under his pseudonym of "Bartimeus," gives an intimate description of the manner of life led by officers and men of a modern man-of-war.

In Chapter 3, the "Authority and Control" of the Admiralty is set forth, and the duties and functions of the officers in command of our fleets and squadrons. It has fallen to my lot to write most of this summary.

It is an extraordinary fact that in most books about the Royal Navy little mention is made of the Royal Marines. Yet that gallant corps forms an integral part of our sea forces. In Chapter 4, Lieutenant-Colonel W. P. Drury, C.B.E., whose vivid and amusing stories of sea life have been a joy to so many, tells of their training, history and gallant actions.

The valuable work being done by the Women's Royal Naval Service is probably little known outside the Navy, which is not to be wondered at, since they form part of the "Silent Service." A corner of the veil has now been lifted, in Chapter 5, by Mrs. Laughton Mathews, C.B.E., the Director of the W.R.N.S. The spirited account she has given goes far to explain the efficiency and popularity of the Wrens.

Battleship construction is dealt with in Chapter 6, jointly written by Mr. John

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H. Narbeth, C.B., C.B.E., M.V.O., and the Editor. Mr. Narbeth is the naval architect who was responsible for working out the detailed design of the original (modern) *Dreadnought*, from the sketch proposals laid down by the Design Committee in 1905. He has since designed many men-of-war of various classes.

Chapter 7 deals with the latest fighting branch of the Royal Navy—the Naval Air Arm. The author desires to remain anonymous but he is an officer who has taken an active part in the air battles of the war.

Admiral Sir Hugh J. Tweedie, K.C.B., contributes a noteworthy chapter (8) on cruisers and destroyers, a task for which his experience as commodore of flotillas in the Grand Fleet alone would qualify him. He was Senior Officer on the Yangtze, Commander-in-Chief on the South Africa station, and rounded off a distinguished active career as Commander-in-Chief at the Nore.

The chapter dealing with submarines (9) is from the pen of Rear-Admiral R. A. Watkins, D.S.O. He has served for nineteen years in the Submarine Service. During the war of 1914-18 he commanded a destroyer flotilla in the Atlantic Ocean. His account of submarine life and work gives an excellent idea of the difficulties and dangers of this type of warfare.

Chapter 10, contributed by Mr. Francis E. McMurtrie, describes the less well-known small craft of the Royal Navy—sloops, corvettes and the like. He has the distinction of being editor of the book more widely consulted by all the navies of the world than any other, *Jane's Fighting Ships*.

In Admiral Sir Studholme Brownrigg, who has written the chapter on gunnery (11) we have an officer who, during his period of service as gunnery lieutenant, was acknowledged to be one of the highest authorities on the subject. He afterwards filled with distinction the posts of Director of the Gunnery Division of the War Staff, and followed this up by becoming Director of Naval Ordnance. Then, returning to the sea as Second-in-Command of the Mediterranean Fleet, he concluded his active career as Commander-in-Chief at the Nore.

The third section of the book deals with operations, and here Captain Ritchie appears again, as contributor of Chapter 12. This describes mines and mine sweeping, a subject well fitted to his pen.

Chapter 13, on general sea strategy and convoys, comes from Vice-Admiral J. E. T. Harper, C.B. This is a subject of very great importance, and well suited to an officer who served at the Battle of Jutland and then as Director of Navigation at the Admiralty. At present he is a nautical assessor to the House of Lords. He is perhaps best known as compiler of the *Official History of the Battle of Jutland.*

Chapter 14, on fleet battle tactics, has been contributed by the Editor.

"Fleets and Naval Bases"—Chapter 15—is not an easy subject to deal with in wartime, when swift changes in dispositions of ships is the order of the day. It was written by Rear-Admiral H. G. Thursfield before Japan entered the war. He is editor of the famous *Brassey's Annual*, Vice-President of the Naval Records Society, and he served for a period as Director of the Tactical Divisions of the War Staff.

Mr. Francis E. McMurtrie contributes another valuable chapter (16) dealing with the navies of the Empire and their history; for this his intimate knowledge of the naval vessels of all countries eminently fits him.

It is impossible in these days to write a book about the Navy without making mention of the Merchant Navy. That gallant service deserves a book to itself; limitation of space has made it necessary to restrict the scope of Chapter 17 to a brief description of the Merchant Navy as part of our armed fighting forces. The author is Sir Archibald Hurd, the doyen of naval correspondents. For some years he has been chairman of the *Shipping Gazette*, and he wrote the official *History of the Merchant Marine* during the war of 1914-18.

Lastly we come to Chapter 18, on amphibious warfare, by Lieut.-Commander T. Woodrooffe, a distinguished author of sea stories. He has succeeded in compressing considerable information into the space allotted to him.

I must thank the Naval Censor and his Staff for their kind help and consideration whilst I was endeavouring to carry out the somewhat stringent rules by which their censorship is guided.

Admiral

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GUARDIANS OF THE HIGH SEAS

In peace or war, in fair weather or foul, the capital ships of the Royal Navy police the oceans. Their power and influence are vital factors in the preservation of freedom and justice

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Section 1. PERSONNEL

CHAPTER 1

The Power of the Royal Navy

Confidence supremely important. Invigorating tradition. Material and moral strength. Ever-present danger. Wishful thinking. Seventy-five years of naval policy. Belligerent rights. Strategy and tactics. The "Two-power Standard." Our foreign policy and sea power

MODERN warfare demands the use of the most modern equipment in all its instruments—instruments which, from the largest battleship down to the submarine, the bomber and the mine, are highly complicated mechanical devices. Any nation which allows itself to lag in the smallest degree behind its rivals in its naval material is doomed to find itself severely handicapped when trouble comes along.

It is no less true that it is useless to possess the most perfect instruments of sea warfare, if the skill and the will to use them are lacking or insufficient.

Events in the Mediterranean during the Second World War afforded abundant evidence of this. When Italy entered the war, her fleet in that sea greatly outnumbered the British. Then she possessed four battleships, ten modern cruisers, about fifty-seven destroyers, some seventy large torpedo boats, one hundred submarines and a large number of motor torpedo boats, a class of vessel on which she had based high expectations at the time of the Abyssinia affair.

In addition to these, she had the whole of her air forces favourably concentrated at bases flanking the central area of the through Mediterranean route. The ally (France), upon whose co-operation the strength of the British Fleet had calculated, suddenly capitulated and the British Fleet found itself confronted by a navy manned by 70,000 men, and which outnumbered it in every class of vessel except the battleship. Yet this formidable enemy made no attempt to obtain command of the sea in battle.

POWER OF TRADITION

Something was lacking. It was not material, all of which was modern; nor positions, for the Italian bases were all well placed and defended. Unless we are to suppose that the Italian High Command imagined that they had evolved some new form of strategy, whereby victory was to be obtained by means other than battle, or in some other theatre than the sea (both assuredly very improbable assumptions), the only interpretation of this passivity seems to be that confidence was lacking. Confidence is a plant of slow growth. Its roots lie in the past, and the past history of the Italian Navy, from the Battle of Lissa in 1866, in the war of 1914-18, and up to the present time, could show little to create confidence, or to develop that spirit of taking risks without which one may seek in vain for victories. In other words, there was an absence of the invigorating and creative breath of tradition.

So, as cannot be said too often, naval strength is composed of two diverse elements: material and moral, neither of

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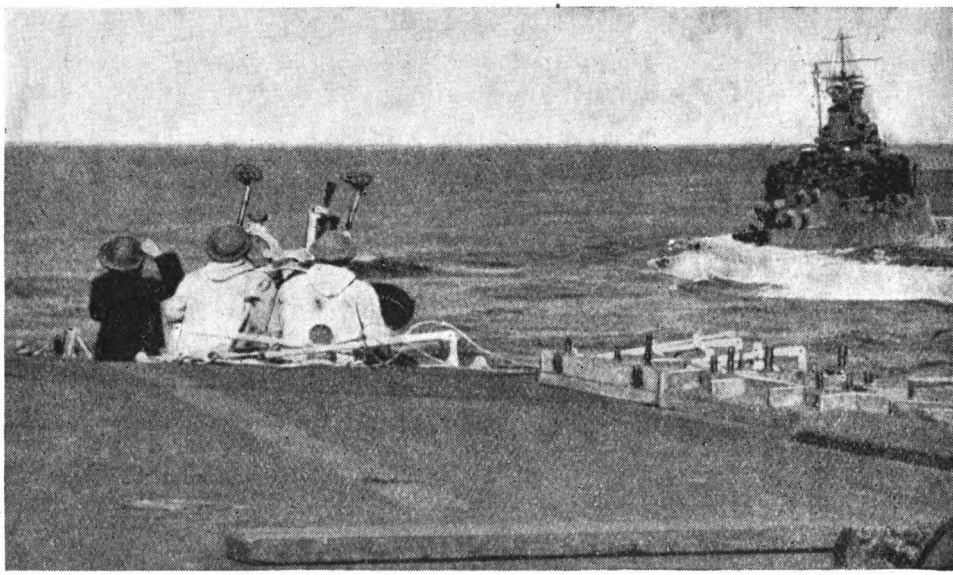

BRITISH WARSHIPS AVOIDING ENEMY

In the evacuation of the Allied forces from Norway, the Royal Navy played an heroic part. When near the coast they were continually subjected to heavy bombing attack. Above, one such

which by itself is enough. Admiral Sir Charles Napier expressed this in the mid-nineteenth century, in these words: "Superiority in naval power will henceforth consist in keeping up a proper naval armament and discipline. The first naval nation to fall will be the one that is caught napping. So that, instead of resting upon our former naval renown, it will be much more to the purpose to watch diligently that this renown is not made to suffer from the neglect of governments to train fleets."

NECESSITY OF MATERIAL

Tradition alone — "resting on our former renown"—is not enough; the material must exist and the personnel must be trained in every element of its employment. But tradition is a stimulant, a constant reminder of what has to be lived up to, a spur to emulation and a source of inspiration. Whenever the material of the Navy has been neglected, through parsimony or a mistaken outlook on world politics, or the morale of the Navy has fallen owing to any of the insidious causes that assail it in times of peace and prosperity, then the Navy, when suddenly called on to fulfil its purpose, has failed or fallen short in its work; and the country has suffered accordingly.

More than once in the initial stages of a war Navy success has been deferred either through lack of sufficient ships or want of vigour in its direction and command. The danger was always present, after the victories and expenses of a long and successful war, that Parliament might be lulled by wishful thinking into a belief that peace was permanent and that the fleet could be neglected. Burke warned his countrymen of this danger: "Of all the public services, that of the Navy is the one in which tampering may be of the greatest danger, which can worst be supplied in any emergency, and of which any failure draws after it the longest and heaviest train of consequences. I am very far from saying that this or any other

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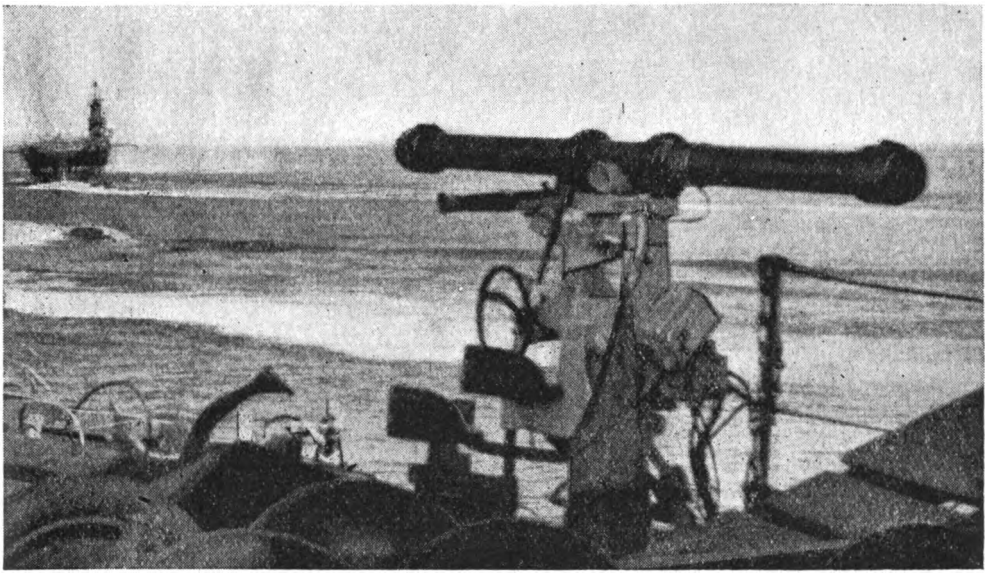

AERIAL ATTACK OFF NORWAY

attack is seen from the deck of a following ship. Bombs have fallen close in front of the leading aircraft carrier and all the ships are turning rapidly to avoid being hit

Service ought not to be conducted with economy. But I will never suffer the sacred name of economy to be bestowed upon arbitrary defalcation of charge. . . . When the author talks of saving in the Navy estimates it is incumbent on him to let us know, not what sum he will cut off, but what branch of that Service he deems superfluous."

Let us glance at our naval policy over the last seventy-five years. Three-quarters of a century ago the country was in danger of being caught napping when Napoleon III started to build an ironclad fleet and to equip a great naval base at Cherbourg. In 1859 he had fifty-one battleships, to England's ninety-six, and ninety-seven cruisers to England's ninety-six. But it should be noted that our apparent superiority in battleships was qualified by the fact that both countries had approximately the same number—about thirty—of the new steam-propelled vessels. Further, the Emperor declared to Lord Malmesbury that he "reckoned on having fifty ships of 1,000 h.p. in the following year," adding with emphasis, "and I promise you I'll double them." (Temperley and Penson, *British Diplomatic Documents*, p. 290.)

REDUCED NAVAL STRENGTH

Queen Victoria showed her anxiety in a letter to Lord Derby in January, 1859: "The extraordinary exertions which France is making in her naval department oblige us to exercise the greatest vigour to keep up a superiority at sea upon which our very existence may be said to depend and which would already be lost at any moment that France were to be joined by any other country possessing a navy."

In other words, departing from the standard of strength that had been maintained throughout the eighteenth century —a strength equal to that of any two powers—England was at the mercy of any chance coalition. The building up of the ironclad fleet followed, and good

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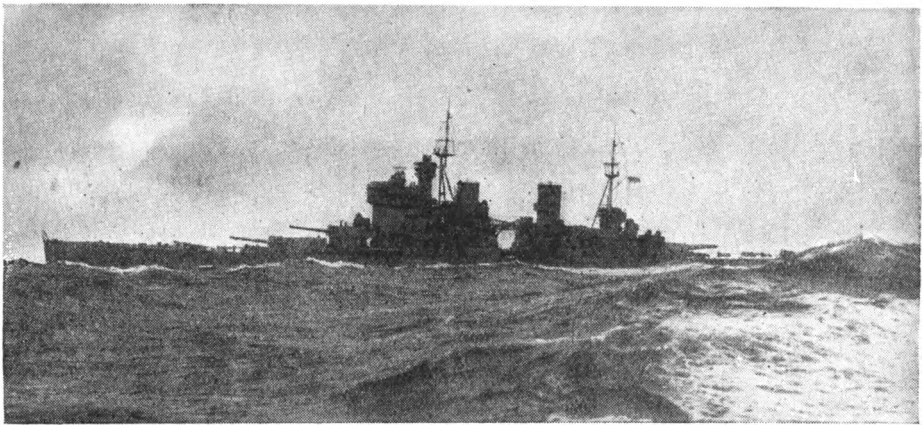

H.M.S. KING GEORGE V IN A HEAVY SEA

Britain's latest battleships, those of H.M.S. King George V class, are vessels of 35,000 tons, with a speed of more than thirty knots; they are armed with ten 14-in. and sixteen 5.25-in. guns

relations were once more established for a time between the two countries. Differences, however, revived a few years later when the colonial policy of France and the eastern policy of Russia brought about incidents in Siam, Madagascar and Afghanistan. Both countries were busily adding to their navies, battleship fleets to contest the command of the sea, and heavy cruisers to conduct a *guerre de course* on the ocean routes; each country arming to defend its interests.

POLITICAL CONSIDERATIONS

In England, towards the end of the nineteenth century, both in political and commercial circles a variety of elements combined to offer opposition to expenditure on the Navy. There were those who believed that war was avoidable by the exercise of goodwill. Some thought that England had no need to intervene in the affairs of the Continent, nor to take a part in the occupation of the undeveloped territories which were then being opened up in Africa. Others held that the policy governing our fighting forces should be based on the assumption that our position would always be that of a neutral, and that, therefore, the belligerent rights which we had needed and exercised since the days of Queen Elizabeth were no longer similarly required.

In brief, there was widespread ignorance as to our traditional policy and of the role of the Navy in the spheres of both international politics and strategy, and this was accompanied by an almost universal belief that the era of ambition and aggression had passed away. While all the traditional doctrines of policy and naval strength were being thrown aside, the Navy itself—except for a few far-seeing men—forgot its traditions and was doing little to encourage the study of strategy and tactics or to adapt old principles to changing modern factors.

Fortunately for the country, there were men, both in Parliament and the Press, who kept the vital necessity of a strong Navy before the public, and courageous officers at the Admiralty who were not afraid to take a stand against the pressure put upon the Board to reduce its demands, and who refused to accept the provision which they knew to be inadequate.

So, gradually, the "Two-power Standard" was once more formulated. It did

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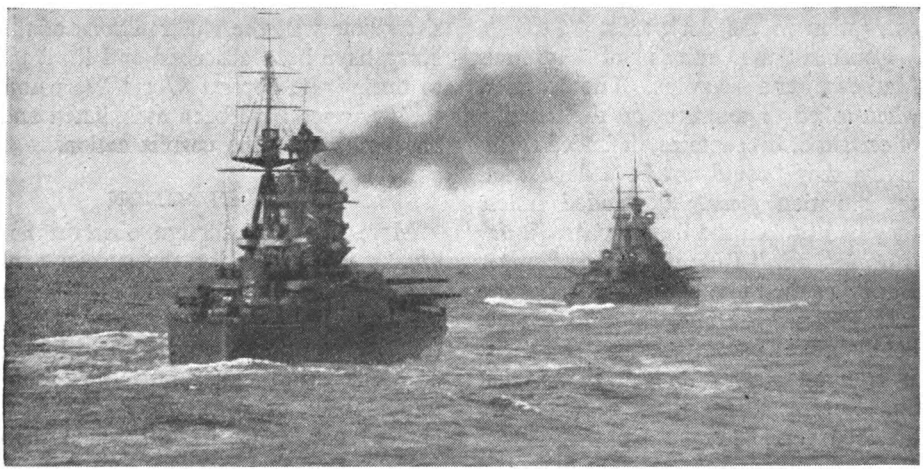
not envisage a mere mathematical equality in tons and guns, but the creation of a naval strength necessary to meet any two Powers; that is, it demanded *strategical* sufficiency. The First Sea Lord, Sir Frederick Richards, further insisted on the need for a margin to meet the waste of war, and called attention to the fact that the wastage in the British Fleet "must be out of all proportion to that of an enemy who may choose to remain in port and try to wear out our fleet by constant harassment and torpedo attacks." (Quoted in A. Marder's *British Naval Policy, 1880-1905*, p. 192.)

Today the supreme wisdom of that dictum has been made very plain by our losses in cruisers and destroyers which have constantly to be at sea exposed to the attacks of modern destroyers, submarines, minefields and aircraft. Meanwhile the surface vessels of the enemy keep their harbours, make short sallies in strength, or cruise in distant areas where they are not exposed to the foregoing dangers. The risks of working to a bare margin, and of basing numbers on insufficient data, are amply illustrated by the situation that followed the rescue of the Army from Dunkirk, when over one-third of the destroyer strength to which the country had been limited by the egregious Treaty of London was either sunk or disabled. Meanwhile our shipping was being sunk by submarines at a rate that spelt inevitable defeat unless quickly checked, there being insufficient ships and vessels remaining for the extended duties of the general protection of commerce. It was, in fact, the very situation to which Richards had with great foresight drawn attention.

TRADITIONAL POLICY

Our traditional naval policy may be roughly summed up in the words of the first Lord Stanhope in the beginning of the eighteenth century: "Our Navy pride themselves on doing their own service without any obligation to foreign help." This was not mere pride. It was the expression of a very clear understanding of the uncertainty that help would come when needed, however sincere the



H.M.S. RODNEY AND NELSON

These battleships are armed with nine 16-in. and twelve 6-in. guns and have a speed of twenty-three knots. The main armament is forward because it was assumed that the naval strength of Britain would enable her ships to attack and not to fight actions on the retreat

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previous promises of such aid might have been at the time they were given. The natural corollary to this determination was the provision of a navy adequate to fulfil its duties and not to count upon the help of other powers.

The other tradition is that which the old seamen call "discipline," and which we call "morale." To attempt to survey the whole field embraced by that word and to explore all the intangible elements —the "imponderables"—that constitute the personal factors in the fighting Service, would call for more space than we can afford. One may, however, select some aspects of the personal element; and, in my opinion, the most outstanding "moral" tradition of the Royal Navy is a readiness to take responsibility.

TAKING RESPONSIBILITY

"The test of a man's courage is responsibility," said the great St. Vincent, a man ever ready to shoulder it in full measure, whether by exposing his ships to the risks of inshore operations off the Black Rocks, or by incurring the calumnies of political gangs in his fight against corruption in the dockyards.

Contrast the minds of Admirals Mathews and Hawke. The former, when asked to comment on the inaction of certain of his captains, defended them, saying they "could not have done what the situation clearly demanded unless they had broken the line to chase, *which is against rule*." Rule did not so hamper Hawke in the same battle. He, seeing an enemy damaged, but about to escape, boldly broke away, attacked and took her. It is upon Hawke, not Mathews, that our officers model their conduct two hundred years later.

The tradition that "to burn, sink and destroy" the enemy is the first duty of the fighting ship, is as fully alive today as it was then. When H.M.S. *Cumberland* heard that the enemy *Graf Spee* was off the Plate, she was at the Falkland Islands refitting, but immediately put to sea without any orders. On his own initiative, her captain readily courted action.

MODERN INITIATIVE

During the *Bismarck* operations, the following examples occurred: H.M.S. *Dorsetshire*, without any orders, left her convoy and proceeded to get in touch with the *Bismarck*; H.M.S. *Cossack* (Captain Vian's ship) was carrying out orders to join H.M.S. *King George V* to provide an anti-submarine screen for the latter, but as soon as she received the signal saying that the *Bismarck* had been located off the Bay of Biscay she proceeded at full speed with the destroyer division to get in touch with the *Bismarck*; H.M.S. *Rodney*, on passage from the U.S.A. to refit, took the appropriate action to intercept the *Bismarck* if she broke back to the eastward.

The zeal, energy and self-sacrifice shown by our destroyers at Narvik, by all our ships in the fighting off Crete, as well as the instant readiness of our fleet in the Battle of Cape Matapan, all go to show how well the old traditions of the Navy have been absorbed and lived up to during the Second World War; how the doctrines have been assimilated and have compelled the correct action.

EFFECT IN ACTION

More than one foreign observer has sought to account for the successes of the British Navy when its ships, no better than those of its enemies, often, indeed, smaller, not uncommonly worn with long cruising, had to fight ships in good condition, fresh, or recently from harbour. One French writer has attributed such successes to the fact that our officers were not afraid of responsibility. Young officers who commanded brigs and other small vessels were not backward, he said, in risking their ships in bad weather or

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AN ESCORT VESSEL AT SEA

Convoy work in heavy seas and cold weather, with a ruthless enemy always to be overcome, is a strenuous task. The sailor seen in the foreground is tightening up gear before nightfall

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THE BLAZING WRECK OF THE GERMAN

The traditional initiative of the Royal Navy has been proved to be as alive as ever. H.M.'s cruisers Exeter, Ajax and Achilles brilliantly intercepted the powerful Admiral Graf Spee in

dark nights when French seamen would shorten sail or heave to, for they knew that even if in so doing they should lose their ship, their conduct would most certainly be approved.

But it would be too much to say that there had not been periods of back-sliding. Long spells of peace tend to weaken this spirit, to create caution, and a fear on the part of those in authority that mistakes may occur for which they will be held responsible.

Sir Edmund Fremantle records an occasion of a missed opportunity during the Russian war of 1854-55: "We were paralysed possibly by orders from home, but more I think by the fear of responsibility which pervaded the Service at that

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POCKET BATTLESHIP, ADMIRAL GRAF SPEE

the South Atlantic. In a running fight they forced her to take refuge, badly mauled, in Montevideo. On the orders of Hitler, her captain later ingloriously scuttled his ship

time, probably from a generation having grown up which had seen no fighting, and in peace cruising the safety of their ships had been the aim of all endeavours."

But though the tradition had then been dimmed the lamp was still alight, and old principles came once more to the fore when destroyers were added to the list of the Navy. The Admiralty from the very start encouraged the young officers who commanded these craft to take risks and not shirk responsibility, and wisely turned a blind eye to the mishaps that were on occasion the result of zeal and not of carelessness.

Tradition is indeed one of the greatest safeguards against degeneracy in the spirit of responsibility. It can be a bad master

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when used to insist that things must be done as they always were done in the past, in different and changing conditions of personnel and material.

What tradition tells us, is why past attempts have succeeded or failed, what steps we took with the material we possessed: and it has caused us to translate the work of the old-time battle fleets, cruisers and flotillas into terms of their successors in the war at sea of 1941. When so employed it is the best of servants. It stimulates the imagination, it strengthens resolve, it brings home many lessons, not the least being that insisted upon by Marshal Foch that no one is beaten until he believes he is beaten.

TRADITIONAL FOREIGN POLICY

There is also the tradition of our foreign policy, and the part which the Navy has ever had in shaping that policy. Sir Edward Grey expressed this in his speech to the Dominion Delegates in 1911: "What really determines the policy of this country is the question of sea power. It is the naval question which underlies the whole of our European policy." (Gooch and Temperley, *British Diplomatic Documents*, Vol. VI, pp. 782-84.)

England, from her peculiar geographical position, has always been bound to oppose any attempt by an aggressive power to dominate the Continent, for the simple reason that such a dominant Power, with the whole resources of Europe at its disposal, would be able to outbuild her at sea and hold her at its mercy. In the whirligig of time the same lesson was brought home to the United States by the President. Hence also the vital need for her intervention. Our intervention in 1939, which was necessary for our security, had also been, up to that date, responsible for preserving the liberty of the small powers of Europe, which normally in peace time have lived upon sufferance; since one or another of the great grasping Powers would, years ago, have swallowed them had they only had their own powers of resistance on which to rely in order to repel invasion and subsequent speedy annexation.

PRUSSIAN METHODS

The monstrous methods and the total lack of scruple which have characterized Prussia during the last seventy-five years serve well to illustrate this fact. In 1865 the small Powers were trembling for their continued independent existences. Bismarck had already shown how he regarded them. He told the Dutch Minister at Vienna that Prussia needed colonies if she was to become a great maritime state; he coveted Holland, less for its own sake than for its wealthy colonies. As to Belgium, when reminded that she was guaranteed by the European Powers—Prussia among them—he replied that a guarantee in these days was of little value. (Morley, *Life of Gladstone*, Vol. II, p. 320.) That which deterred him from seizing those States was the knowledge that he would have to fight a confederation of which Great Britain with its sea power would be a member.

NAVY AS DETERRENT

The cynical Bülow tells in his *Memoirs* the same tale, that it was the opposition that would arise, and not any question of international or other morality, that acted as a deterrent to German aggression.

"Should we," he asks, "undertake campaigns of conquest southwards, eastwards and westwards, annex new territory in the north? Should we force smaller neighbours to join us? To the old foes of the Empire should we add new ones? No far-seeing German patriot could wish that . . . *le jeu ne valait pas la chandelle.*" And again: "I have seen in documents I had studied at Lemmering that the naval authorities were thinking of a number of bases on the potentially

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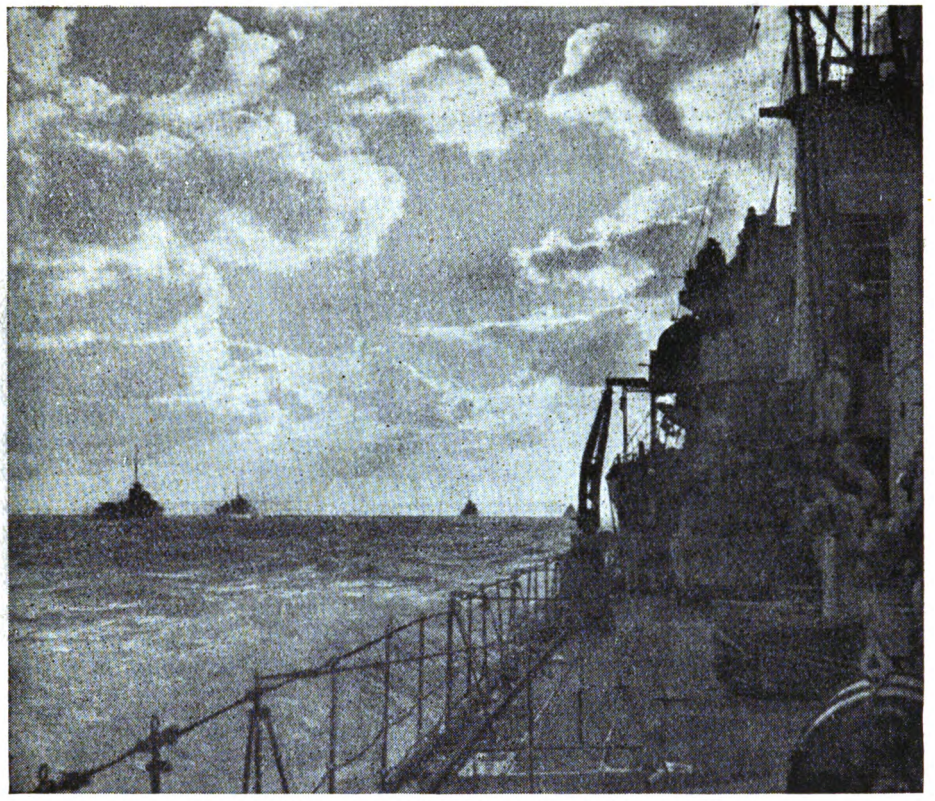

BRITISH DESTROYERS AT SEA

In spite of the size of the Italian Navy and the many heavy and varied commitments of the Royal Navy on the Seven Seas, British naval units make continual aggressive cruises in the Mediterranean. These destroyers, in line ahead, are on patrol in Mussolini's "Mare Nostrum"

rich coast of the Pacific. We would have to wait for the right moment to take possession of them. The Far East on the one hand, and Asia Minor on the other, were lands from which we would not allow ourselves to be excluded. But we must walk warily." (Von Bülow, *Memoirs*, Vol. I, p. 57.)

Here is one other reminder of the long-plotted aggression that is now in course of being so ruthlessly carried out, and the reason why it was not done sooner:

"General den Plessen . . . added that it was a matter of the highest importance for us to have, not only Denmark in our hands, but also Holland and her colonies, if it was for nothing more than the urgent need of coaling stations. As I called his attention to the fact that these plans could not be carried out without sanguinary conflicts with all the great Powers, including America, the general agreed that their realization must perhaps be deferred until some distant future." (op. cit., Vol. II, Chapter VII.)

In those extracts we can see, naked and unashamed, the genesis of the wars of 1914-18 and of today. The sole obstacle to the policy of aggression was the opposition with which it would meet, and in that opposition the British Navy

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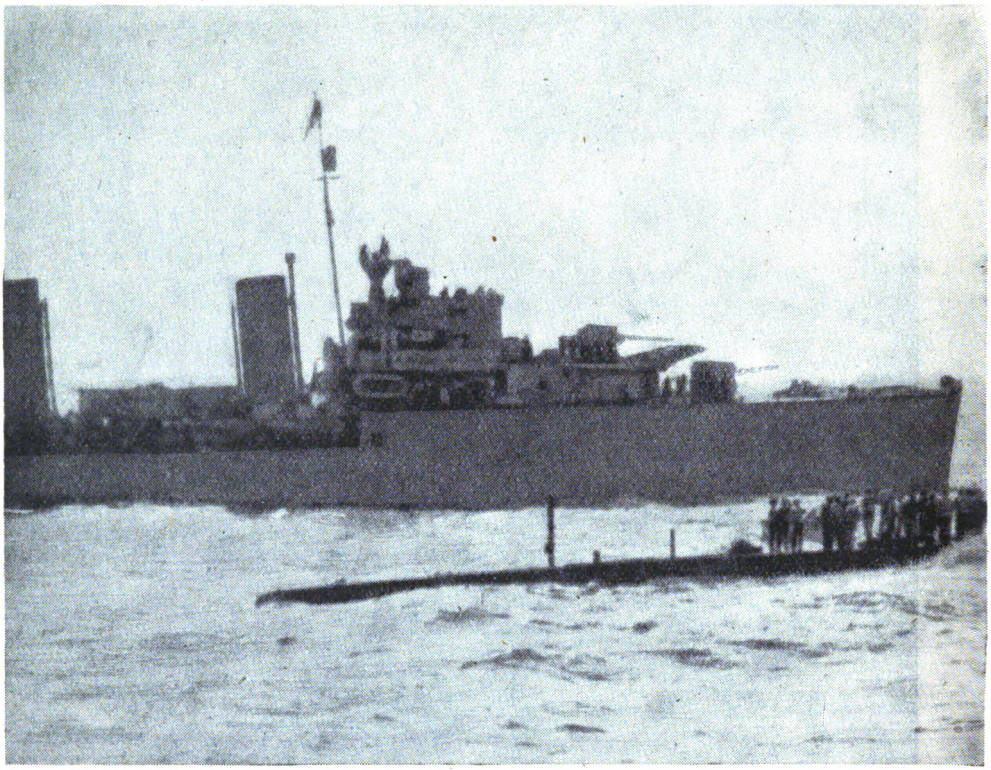

BRITISH DESTROYER FORCING AN

An unceasing struggle goes on between surface and underwater craft. This British destroyer has forced an Italian submarine to the surface by means of depth charges. The enemy crew

held a high place. If the help of Britain and her fleet, or even if her neutrality could have been counted on, the rulers of the robber State would have dropped their hesitations. But they could be sure that, following her traditional policy, Britain would not stand aside; and they knew that should she intervene the whole influence of her sea power would be thrown into the struggle.

Even in her war with France in 1870-71, which was mainly confined to land fighting, Germany felt the effects of sea power. Von der Goltz complained that owing to the French command of the sea, France was able to import weapons from America and, by their means, continue the fight after the surrender of the Army at Sedan. And she knew that, provided the will to unite and fight existed, the British Navy would be the determining factor in resisting the desired German conquest of Europe.

The British Navy has played the major part in preserving the liberties of the small nations, staving off for the last fifty years the catastrophe which has now fallen on the world, since it has been the power behind the diplomats who have been responsible for settling disputes that might otherwise have led to war. Though it cannot be said that fear has been the sole reason why war did not break out at any of the many times when severe friction occurred between Great Britain and France and Russia in

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ITALIAN SUBMARINE TO SURRENDER

are seen on deck awaiting rescue by the destroyer's boats. Wherever possible, British naval units (unlike those of the enemy) always try to be humane in rescuing defeated enemies

the last seventy years, it can hardly be open to doubt that the Navy exercised a most sobering influence when war and peace lay in the balance.

Though the language of threat was not used in the disputes over Penjdeh, Siam, Madagascar, the Persian Gulf, the Dogger Bank incident, or Fashoda, our foreign secretaries in dealing with these delicate questions had the backing of the sea power of the country, without which there is small doubt that matters would have turned out very differently. During this period—September, 1898 to March, 1899—we were on more than one occasion within an ace of war, according to M. de Freycinet (*Cambridge History of British Foreign Policy*, Vol. III, p. 254).

One further concrete example of naval influence will suffice. Several powers in Europe took a hostile view of the action of Britain with regard to the South African War. Germany endeavoured to create a coalition against us; but she was unable to enlist support and, alone, she was not able, bitter though her feelings were, to give material assistance to our opponents. The frenzied efforts of Dr. Leyds to procure aid from Berlin failed; the reason for the failure was most significantly given in a famous telegram to his government: "Minister of Foreign Affairs Germany says Germany still friend of South African Republic but cannot assist in war because England master at sea" (Milner, *Papers*, Vol. I, p. 393).

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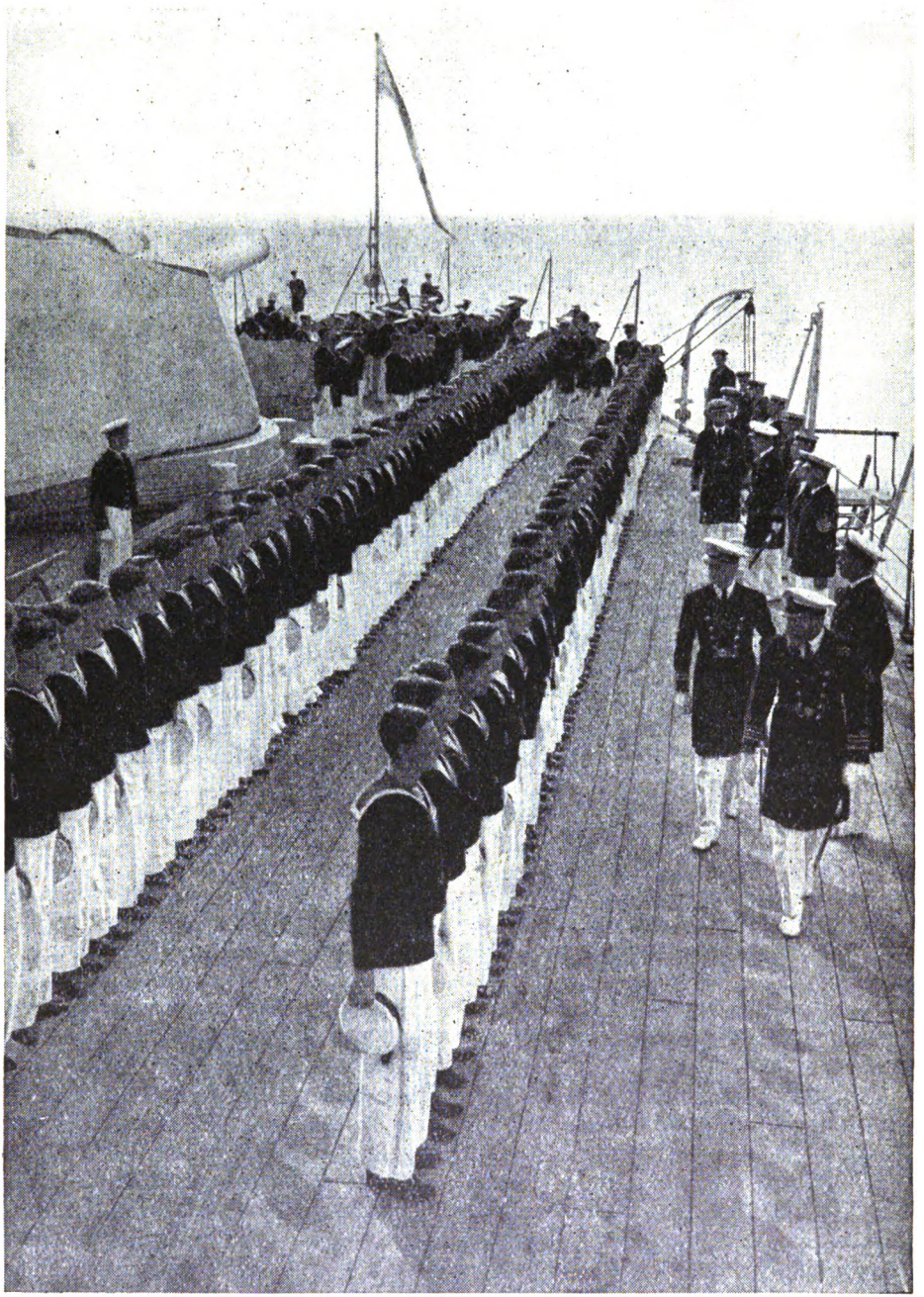

A PEACE TIME INSPECTION OF HIS MEN BY THE CAPTAIN

The captain is responsible for the actions of every individual under his command. How they will react in battle depends largely on the spirit he has instilled throughout his ship

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CHAPTER 2

Life On Board a Battleship

A unique institution. Function of the man-of-war. Unquestioning obedience. The ultimate responsibility. The articles of war. When shells burst aboard. Loneliness of high command. Traditions of the sea. Decentralization of organization. "Spit and polish." Science of navigation. The administrative side. Messing and recreation

"Whilst the ship . . . may and must fight for the principles of human rights . . . the ships themselves must be ruled and commanded at sea under a system of absolute despotism."—John Paul Jones to a Naval Committee of the American Congress, 1775.

In every human mass organization there are two sides, the executive and the administrative. One issues orders to whatever end that organization is directed. The other concerns itself with what may be broadly called the welfare of the personnel of that organization, so that it is maintained in health, is paid and clothed and fed, and lives under conditions which make for maximum contentment and therefore efficiency.

A man-of-war is a unique institution, and further analogy with other institutions will not carry us far. In the first place it is a ship. That is to say, the primary consideration of its officers and men is for its safety from the elements. From the moment it is launched, as long as it is afloat, a ship is in hazard to forces that menace its existence: gales, fog, ice, tides, shoals—in all these there is potential destruction. It is like living in a house which, but for ceaseless vigilance night and day, a most specialized knowledge, and a whole lot of ethical virtues on the part of the tenants, is liable to collapse without warning about their ears.

The primary function of the man-of-war, as its name implies, is to fight. This is uppermost in the minds of its designers, and all other considerations, such as the comfort of the personnel, are subordinated to this purpose. To fight a successful action, the whole complex organization must respond instantly to an order. The failure of one individual to do so may result in the involuntary failure of the whole, which means defeat. And so, both in peace and war, it is necessary to teach and maintain discipline—that is, instantaneous and unquestioning obedience to orders—to a higher degree than is met with in any other mass organization.

AN ABNORMAL LIFE

There is one other aspect of life on board a man-of-war which must be briefly considered before going into a more detailed description, and that is the fact that it is abnormal. It is abnormal in that it banishes men from the sights and scents of rural nature: woods, trees, flowers, birds and so on, from their homes and family influences, from the companionship of the opposite sex: it segregates them in entirely male communities that vary from 1,500 men in a modern capital ship, to a dozen or so in a mine sweeping trawler. This segregation may be imposed for a few days at a time, or a few weeks or, such are the exigencies of war, several months. But

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THE LONELINESS OF HIGH COMMAND

The captain is a man alone—he must make every decision himself and has to bear full responsibility for it. If he paces the quarter-deck he selects the starboard side, and anybody who happens to be there immediately vacates it for the port side. It is the tradition of the sea

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whatever breaks there are, a few hours', or a few days', or a few weeks' leave, this abnormality is a condition of life afloat; it extends throughout a man's service, through commission after commission, at home and abroad.

Now let us consider the captain, the man in command of this ship of war. And while we are about it, let us suppose that it is a battleship, because that is the largest and most complex of all commands afloat; all other types tend towards simplification of organization (except perhaps the highly specialized aircraft carrier) as they descend in the scale of armaments. A battleship is, however, the most powerful of all warships.

CAPTAIN'S RESPONSIBILITIES

The captain of a battleship carries the ultimate responsibility for every word spoken by, and for every action of, an individual on board his ship. His also is the more immediate responsibility for her safety and war efficiency. For conduct in war he is guided by the articles of war, which enjoin that he shall "use his utmost exertion to bring his ship into action, and during such action, in his own person encourage his inferior officers and men to fight courageously."

Here you will see that two of his responsibilities, the safety of his ship and the taking of her into action, must be balanced one against the other. In some circumstances the latter outweighs the former, as in the case of H.M.S. *Jervis Bay*, whose captain, by fighting to the last against hopeless odds, saved most of his convoy from destruction. Consider for a moment this taking of a ship into action by the captain. He is on the compass platform. The navigating officer and the officer of the watch are there too, but they are there to obey his orders: in as much as he must make every decision himself, and has to bear full responsibility for it, he is completely alone. The ship is moving through the water at whatever speed he alone has ordered.

The guns' crews are all at their stations. When he gives the order they will open fire. When they fire, whether they hit the enemy or not will depend upon the training he has ensured these crews have had, and whether the whole enormously complex mechanism of fire control and guns has been maintained to produce its maximum efficiency at this moment. And lastly he has to consider the moment ahead when the enemy's shells will burst on board his ship. How his ship's company will react to that almost inevitable moment, how much or how little it will affect their morale, will depend upon things almost indefinable, upon "all their yesterdays," upon the spirit that he has instilled throughout his ship.

This loneliness of high command accompanies him wherever he may be, on board, at sea or in harbour, in peace and in war. He lives alone, in fact as much as in spirit. If he paces the quarterdeck he selects the starboard side, by the custom of the Service, and anybody who happens to be there immediately vacates it for the port side. There is nothing of the cold shoulder about it; it is the tradition of the sea.

THE COMMANDER

It is apparent that, however great the captain's ultimate responsibility may be, it is impossible for one individual to administer in person and to be familiar with the technical and mechanical details of every department of his ship. The whole organization of a man-of-war is therefore one of decentralization, of delegated authority. This authority, as we have seen, falls into two main divisions: executive and administrative, and we will consider them separately, the executive first.

The commander bears a rather misleading title, because he is in fact the

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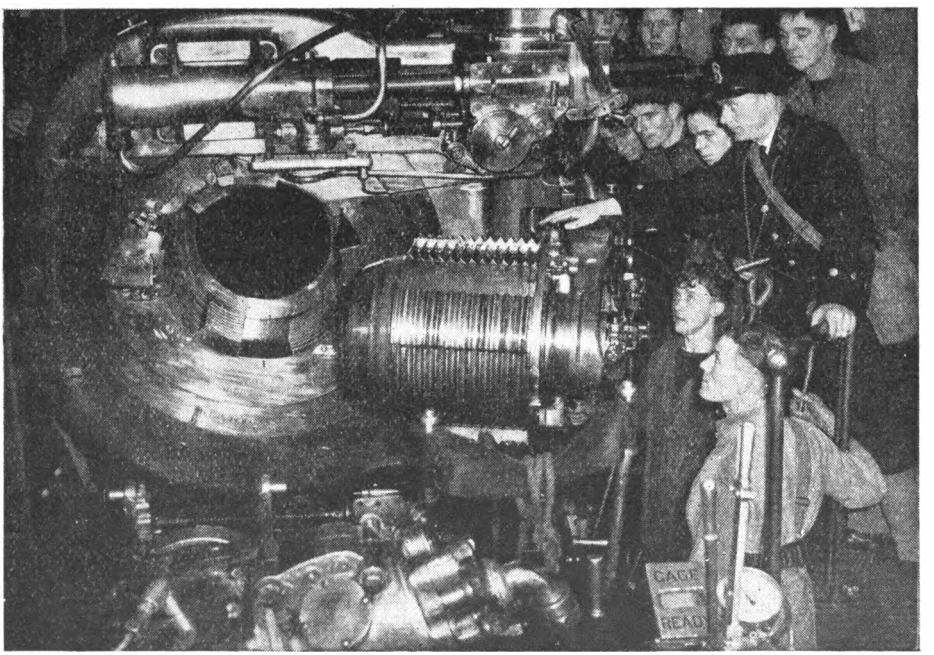
second-in-command. He might be described as the managing director of the concern, if there is any analogy in a man-of-war with a business ashore. The name by which he is colloquially referred to—"the bloke"—is really very much more expressive, whereas the captain is known as "the owner."

CONTROL OF SHIP'S ROUTINE

The commander is the *deus ex machina* who controls the daily routine of the ship and regulates the employment of its deck personnel. He does this in consultation with all the departments who have claims on the ship's man-power. A ship is a vast human hive requiring ceaseless labour to keep her clean. This is necessary not merely from the hygienic point of view, but because dust in suspension in the air is what conveys the flash of an explosion through the igniting of its particles: the cleaner the ship the more chance of the damage caused by bursting shell being localized. This fundamental principle is sometimes lost sight of during long periods of peace, resulting in "spit and polish" being regarded as an end in itself; but in war it is no more than a means to a practical end.

With this necessity in view the commander has to consider other requirements. Anti-aircraft guns have to be continuously manned and an uninterrupted look-out provided. The gunnery and torpedo officers may claim the guns' and searchlights' crews for drilling. A spell in harbour necessitates boats' crews and storing or provisioning parties being provided. Training classes to qualify the younger men for advancement, and school for the boys, have to be fitted into the work of the ship, and when practicable leave must be granted. Not only must



BIG GUN CREWS IN TRAINING

The gunnery officers are responsible for the efficiency of the gun-crews. When the guns fire, whether they hit the enemy or not will depend upon the training these crews have received

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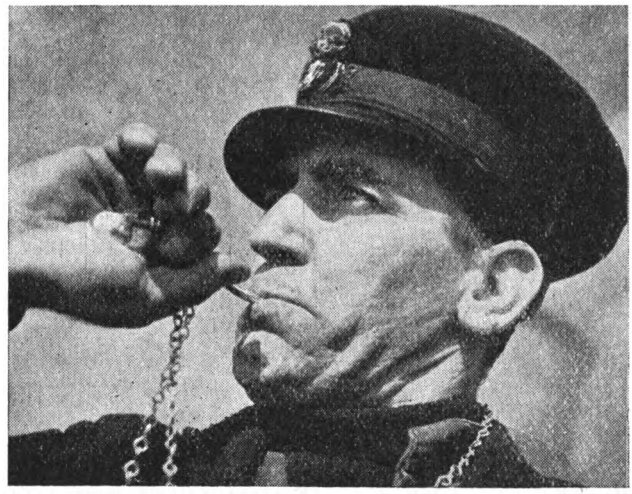
the ship be served but the process must be, as far as possible, without friction or unnecessary "driving."

Except in times of emergency, meal hours and men's leisure must not be interfered with, and whatever task is allotted to an individual or a party of men, that task should be within their professional scope —in other words, nobody is told off for a job which he cannot reasonably be expected to carry out efficiently.



THE BOS'N PIPES THE ORDERS

Orders are conveyed by bos'n's pipe or bugle, and over loudspeakers throughout the ship to the individuals who obey them

We will suppose that the commander's orders for a day in harbour include the following: at 09.30 hours a working party of ten hands is to be sent to the dockyard to draw stores. This involves a boat, and the detailing of the working party. The men are warned overnight by the commander's office. At the proper time the boat has to be called away, that is, manned and brought alongside, and the working party assembled and embarked. The commander cannot concern himself with details of this sort. He has ordered the working party the previous night and dismissed the matter from his mind.

The rest is the concern of the officer of the watch, who may be a lieutenant or a sub-lieutenant. His rank is immaterial; but by virtue of his office he gives orders which put into immediate effect the intentions of the executive brain of the ship.

It is part of the process of decentralization, and we could carry it a great deal further by showing in detail how these orders are conveyed by pipe and bugle, through loudspeakers throughout the entire ship, to the innumerable individuals who obey them.

Apart from regulating the work of the ship, the commander deals with defaulters and "request men." The punishments he may award are laid down by regulation. The more serious offences are dealt with by the captain. Officers of divisions (of whom more later on) bring men before the captain for advancement and the award of good conduct badges. But bereavements, domestic upheavals, things which may necessitate leave being granted, or helpful advice, the commander either deals with himself or passes on to the captain, according to their gravity. In some cases the assistance of the lower deck's great self-help organization, the Royal Naval Benevolent Trust, is invoked.

FIRST LIEUTENANT

Again it is apparent that the commander's executive responsibilities must reach a point where it is necessary to pass on some of the details to others. The apportioning of men to their respective messes, looking after their comfort in them and the order and cleanliness of the mess decks, he relegates to the

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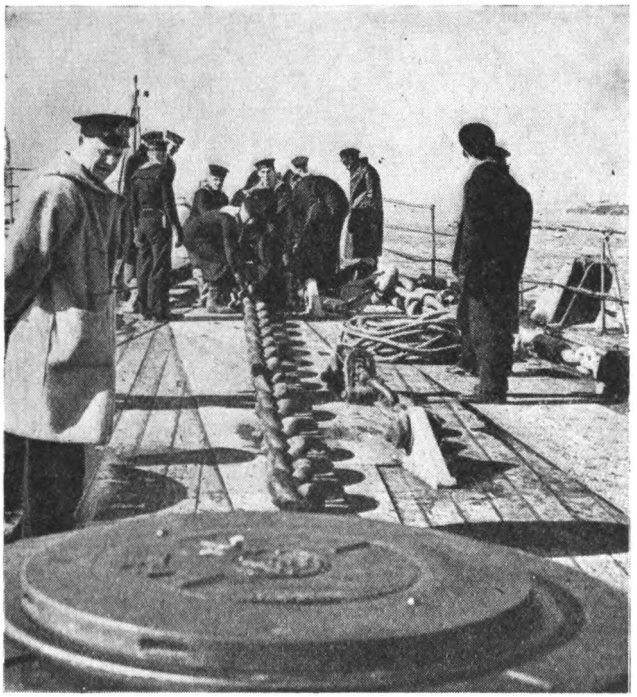

"JIMMY THE ONE"

By custom of the Navy the first lieutenant, or "Jimmy the One," as he is called, is in charge of cables and cablework on the forecastle. Above, on the left, he is seen superintending the weighing of the anchor. He is the commander's right-hand man

senior non-specialist lieutenant on board, although he also keeps a watchful eye between decks to see that everything is going as it should.

"Jimmy the One," or "number one," which is the first lieutenant's popular nickname, stands in a more domestic relationship to the ship's company than any other executive officer. Because his province is the mess deck, his presence there is familiar; his rule is over hammocks and mess kettles and the *déshabillé* of leisure. With the exception of the divisional officers no other officer, unless his duty carries him through the mess decks, or on the occasion of captain's rounds, enters them during leisure hours. When he does, he removes his cap in token that his presence (in what is, in effect, the men's private living-quarters) can be ignored.

The first lieutenant keeps an eye upon the harmony of messes, weeding out occasional temperamental misfits and transferring them to other messes. The cleanliness of mess "traps" and mess decks is promoted by stimulating rivalry between messes and mess decks. Visitors are conducted to "show" mess decks where even swill buckets are burnished, and you could, as the phrase goes, eat your meals off the deck, though no one would encourage you to do so.

Meals, as far as the selection of menus and the cooking and serving of meals go, are the province of the paymaster, but that forms part of the administrative side of the organization which we shall deal with later in this chapter.

By the custom of the Navy, the first lieutenant is in charge of the cables and cablework on the forecastle. In action he controls a part of the ship's armament—usually anti-aircraft, and he may, in smaller ships, combine his mess deck duties with a specialist qualification.

THE ENGINEERS

At this point we must turn from the decentralization of the executive organization (which we have seen pass from the captain to the second-in-command, who transfers its domestic details to the first lieutenant) to another department, the engineers. To return for a moment to

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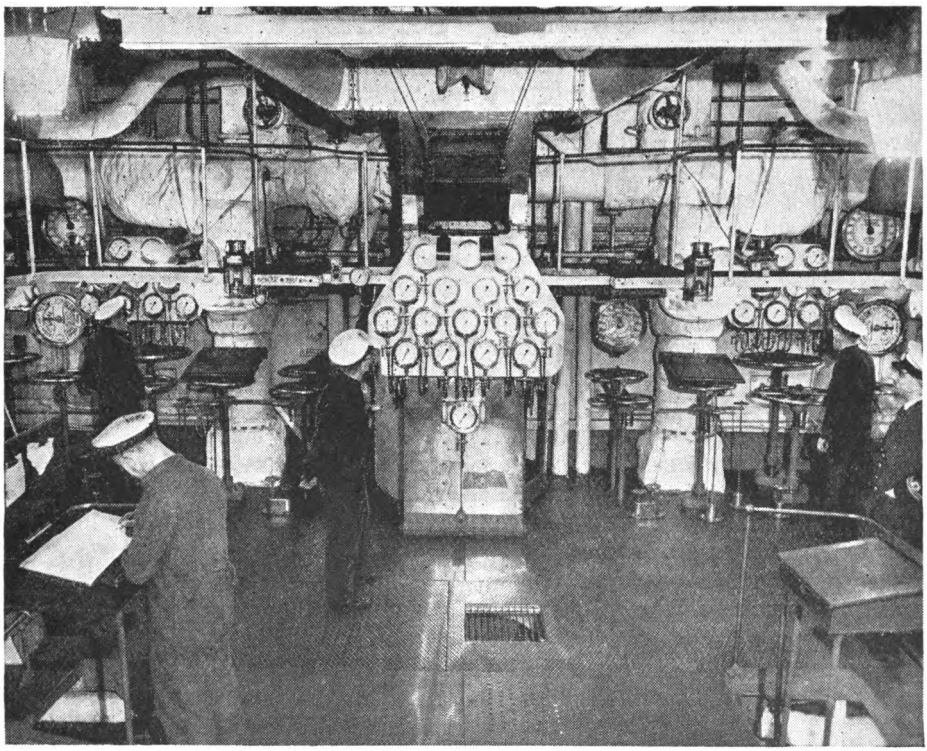
the captain on the compass platform when the ship is going into action. Somewhere in the interior of the ship is a potential energy of about a hundred thousand horse-power compressed like a genie in a bottle. We have seen that the captain gives an order for a certain speed and the ship obeys. How is it done? Who controls the genie and uncorks the bottle in which so much power is stored?

Here we come to a department which is administered by men who are purely specialists—the engineer officers. They are not, as is the case with all other departments on the executive side, seamen who have had specialist duties grafted on to their primary function. The naval engineer officer, although his early training may have been the same as the seaman officer's, becomes identified entirely with the mechanical organization of the ship. He is responsible to the captain that the ship is capable of whatever speed is required of her, and that she maintains that speed as long as is necessary. Consequently he is responsible for the maintenance of her machinery, and that she has on board enough oil fuel in her tanks, and fresh water in the boilers and drinking tanks, to reach any given destination or perform a specified service.

Apart from producing the energy which drives the ship, the engineer officer diverts a part of it to run the



IN THE ENGINE-ROOM

The engine-room is run by purely specialist officers who are responsible to the captain for the mechanical efficiency of the ship. Under them there are engine-room artificers and mechanicians for watch keeping and maintenance, and for less highly technical duties there are stokers of various grades. The illustration shows a typical scene in the engine-room of a capital ship

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dynamos, which provide lighting and ventilation throughout the ship; and to work the hydraulic power for the guns and turrets, which enables them to be loaded, trained and elevated. He keeps the air which ventilates the ship warm in cold weather, and maintains the refrigerators where fresh meat is kept.

ENGINE-ROOM STAFF

As in the case of the other heads of departments his work is greatly decentralized. He has lieutenants and warrant officers, artificers and mechanicians for watch keeping and maintenance. Engine-room artificers are specialized "tradesmen," who have their counterparts ashore —fitters and turners, boilermakers, engine-smiths. For less highly technical work he has chief stokers, stoker petty officers, leading stokers and stokers. The title conjures up open furnaces which have to be laboriously fed by hand, but the modern oil fuel-fired furnace, into which oil is forced at high pressure through sprays or nozzles, is controlled by one man manipulating a series of wheels. Vast fans suck air down into these air-locked boiler-rooms to feed the flaming jets with oxygen. The stoker of old worked stripped to the waist. In high latitudes the modern stoker wears a duffle coat in the boiler-room; icicles sometimes form overhead in winter.

In action the engine-room department, apart from its normal duties, provides fire parties, men in special asbestos suits trained in chemical fire-fighting. It is in instant readiness to flood a magazine threatened with fire or to pump out a flooded compartment. It may be called upon to repair damage in the heat of action, and after battle to carry out vital repairs to hull and structure, thousands of miles from the nearest dockyard.

Never in all the history of steam has so much been asked of the marine engine and the men who serve it, as in this war. Ships have run continuously without refit to mileages undreamed of by their designers. The engineer officer and his department are used to working on a narrow margin between efficiency and disaster. And in this knowledge:

> *"They do not preach that their God will rouse them a little before the nuts work loose.*
> *They do not teach that His pity allows them to leave their job when they damn well choose."*

Devotion to the machine he serves is inherent in the profession of the marine engineer. The Navy adds to this its traditions and discipline—whatever it is that enables men to stay at their posts amid scalding steam or flying splinters to give the ship life to the last.

We have seen how the ship obeys the captain's orders as far as her propulsion goes. That she responds to those orders to a precision measured by a single revolution of her propellers, and maintains that speed as long as is required of her, is the responsibility of the engineer officer and his department. But how she gets to her destination (that is to say, what course she must steer), what her position on the surface of the ocean is at any given moment, the whereabouts of reefs and shoals, minefields, the strength of adverse currents in her course—none of these is his concern. Here the navigating officer takes over.

NAVIGATION

The science of navigation is largely astronomical. Apart from his specialized mathematical knowledge the navigator, or "pilot" as he is familiarly called, has certain instruments and publications, which are the tools of his craft, to work with. He has the chart. This, besides giving an outline of the land, shows the depth of the water (the soundings), the nature of the bottom of the sea (sand,

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rock or mud), lighthouses and buoys, local variation of the magnetic compass, the set of known currents, wrecks, and of course the position of minefields—and those of the enemy when ascertained—and of channels cleared by minesweepers. Charts are kept up to date by means of daily messages sent out from the Admiralty and by printed Notices to Mariners.

CHECKING THE SHIP'S POSITION

The navigating officer, or "pilot" as he is familiarly called, is responsible for seeing that the ship steers the correct course. He works out his ship's position by means of his chart, and the principal instruments he uses for this purpose are the compass, the sextant and the chronometer

The navigator's principal instruments are the compass, which enables him to steer and take bearings of objects; the sextant, by which he ascertains the altitude of the sun and known stars; the chronometer, which is an accurate clock giving the mean time at Greenwich. These last two enable him to calculate his position. When the sun and stars are obscured he has to rely on dead reckoning for finding his whereabouts. Here he is helped by a device called the log, which records the number of sea miles the ship has travelled in an hour. This method is unreliable because it does not take into account unknown currents and the drift caused by the wind. Here again he is to some extent helped by taking soundings, and by comparing the results obtained with the soundings shown on the chart in his supposed position.

Because the responsibility for the safety of the ship rests with the captain, in narrow waters or thick weather he probably checks the navigator's bearings and courses. But, as in other departments, it is plain that it is impossible for the captain to master the entire technical knowledge of the specialist.

At the same time he must be always aware of the situation at sea from the navigational point of view, in the same way that he is alive to the training and

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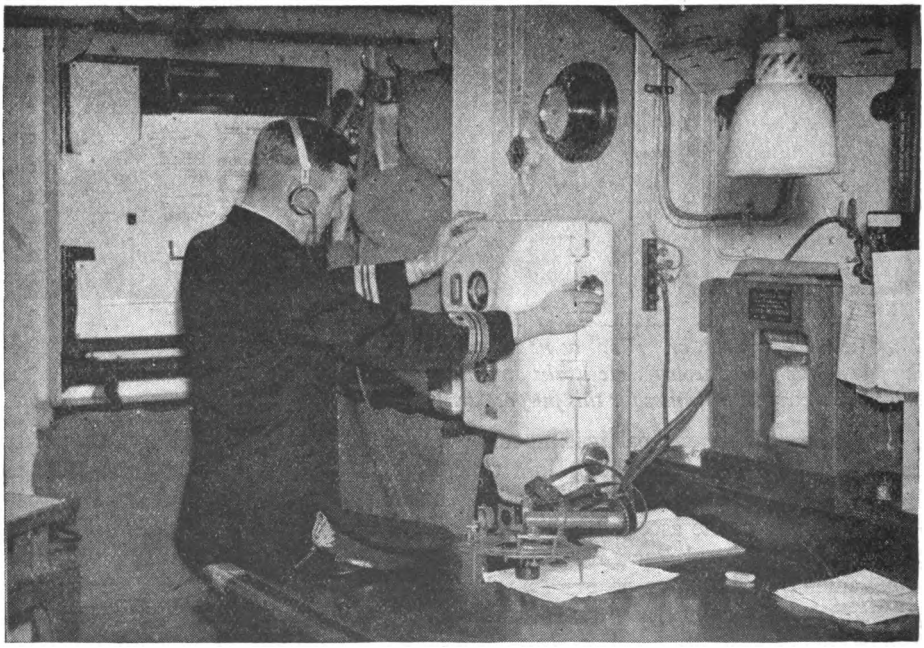
work of the ship's company. And so the two officers in the ship closest in his counsels are the commander and the navigating officer. He has not so much delegated functions to them; their duties are, as it were, a part of his function of command.

The navigating officer has at times a responsibility so great, so directly personal, that it may be wondered how men can be found to undertake it. He relies, of course, upon mathematics to a large extent, and mathematics cannot lie. But he can mistake the marking on a buoy, a degree on the quadrant of a sextant, or make miscalculation in arithmetic; the element of human error stands always at his side, a hooded figure waiting for a moment of fatigue to undo him. Navigators do not count on second chances. Their first mistake can well be their last, and the price of it may be reckoned in millions of the nation's money and many human lives. Yet navigators are cheerful people, and their sleep, when they can get it, is untroubled by reflections of this nature.

They are trained at the School of Navigation, an institution affectionately referred to by the Navy, guided over the face of the deep by its *alumni*, as "The Wreckers' Retreat."

ARMAMENT OFFICERS

In regulating the employment of the deck personnel (that is, the seamen, as distinct from stokers, artificers, artisans and so on) we have seen that the commander has to consider the claims on his resources of the ship's armament officers. In time of war these claims are paramount. The entire armament is not, of



TAKING SOUNDINGS

It is frequently necessary for the navigator to know the depth of water beneath his ship. This may be ascertained by heaving the lead or by means of the complicated electrical echo device shown above which sends an impulse down to the sea bed and records the time it takes to return

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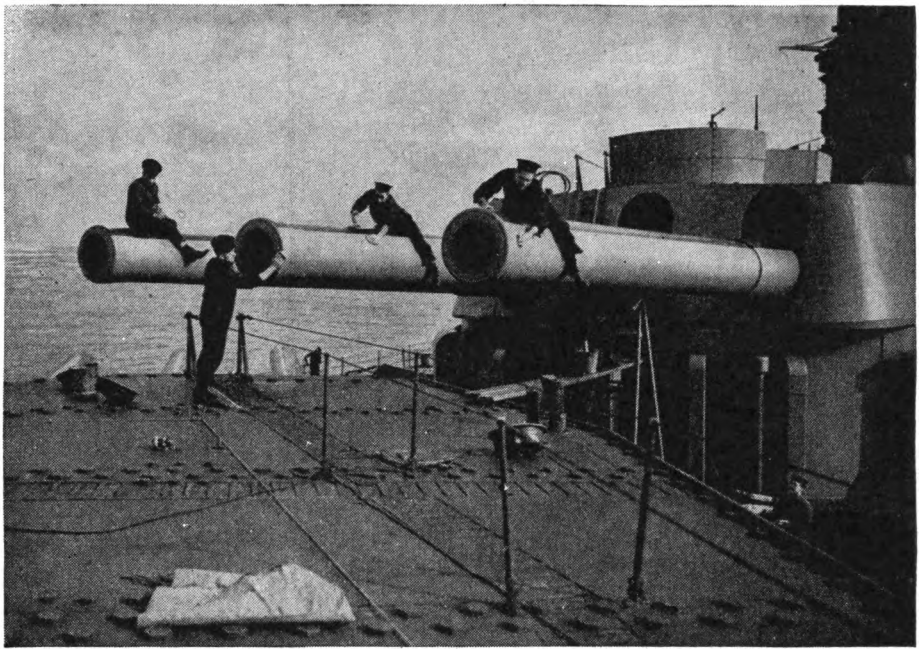

CLEANING THE BIG GUNS

To the landlubber the amount of "spit and polish" that goes on in a battleship may seem unnecessary, but there is a very good reason for this apparently excessive cleanliness. Dust is dangerous when guns are fired. The flash from the explosion may be conveyed to the magazine by dust held in suspension in the air. This has on occasions caused very serious accidents

course, continuously manned, but certain guns and apparatus connected with anti-aircraft and close-range attack are manned day and night, at sea and in harbour. At sea the main armament is partly manned all the time, fully manned a good deal of the time, and there are frequent drills.

The guns', torpedo tubes' and search-light crews, look-outs, fire and repair and ammunition supply parties, absorb practically the entire seaman complement, so it will be seen that under war conditions in any degree of readiness for action the regulation of the ship's routine, although remaining in the commander's hands, must satisfy the requirements of the gunnery and torpedo officers.

Gunnery is dealt with in Chapter 11, but we may mention here that landing parties from ships form part of the gunnery and torpedo officers' responsibilities. The former supplies equipment, arms and ammunition; the latter, demolition and electrical stores, such as field telephones. The Marine officer is in charge of the spearhead of these undertakings, since the Royal Marines are normally the first to land; but if seamen are landed as well, the whole operation will probably be commanded by a senior executive naval officer, possibly even by the commander himself. The gunnery officer never actually lands, but he helps to plan the operation and is responsible for the training of all seamen elements; but here again we are drifting into the province of amphibious warfare, which is the subject of Chapter 18. The armament officers are also responsible for the explosives and ammunition on board.

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Specialization such as the navigating officer's is comparatively static in its development. But that of the gunnery and torpedo officers, owing to new discoveries in sciences such as ballistics and explosives, and the invention or countering of new weapons, is ceaselessly and increasingly progressive. They are both seamen and scientists, holding as it were in one hand a bunch of spunyarn and in the other the keys of death.

LIEUTENANTS AND "SUBS."

So far we have tried to draw a picture of life on board a battleship by describing the responsibilities of the heads of the departments on the executive side. We have not space to deal in detail with the work of all their subordinates, but we must consider certain functions carried out by lieutenants and sub-lieutenants.

Apart from taking turns as officer of the watch, lieutenants and sub-lieutenants have other duties. They are assistants to the specialist officers; they are in charge of divisions of the ship's company and, under the first lieutenant, of the mess decks where their divisions live. They are in charge of individual turrets and groups of pom-poms; and in all these activities they have midshipmen to assist them. Lieutenants of eight years' seniority are automatically promoted to lieutenant-commanders.

Reference has been made to the officer of the watch, as being the commander's mouthpiece, giving effect to his orders. But he is more than that. In harbour he is vested with the authority of the captain; he is responsible for the safety of the ship and for discipline on board. All defaulters and all complaints are brought before him. Assisted by the midshipman of the watch, he sees that the routine of the ship follows its traditional course—that the bell strikes the hour, that the pipes and bugles sound at the appointed times. At sea, besides keeping an eye on the routine, he is responsible that the ship is kept on her course and maintains her bearing on other ships, and that orders to helmsman and telegraphmen are correctly obeyed. In harbour, in peace time, the officer of the watch wears a frock coat and sword belt, and carries a telescope, as symbols of his office. The frock coat is not part of the naval uniform in time of war; the monkey jacket is substituted.

In trying to trace the gradual decentralization of authority from the captain downwards, which plays so large a part in life on board, queer deviations are brought into the picture by the traditions and customs of the Service.

For example, the status of the midshipman is partly one of "makee-learn," and at the same time of authority. No boy of his age in any other walk of life has such responsibilities; and in no other institution than the Navy could such peculiar relationships exist as those between the midshipman of a boat and his coxswain, the gunners' mates and gun layers, the petty officers of his division and the warrant officers.

They are his subordinates and yet, at the same time, they help him to learn his job. In a mysterious way they contrive to advise him and to obey his orders, and for a century and a half the system has not only worked, but enriched the whole tradition of the Navy.

WARRANT OFFICERS

Lastly, we have to consider a class of naval officer whose status, titles and duties are still bound up with traditions older even than those of the midshipman, traditions as old as the Navy itself. The warrant officer is promoted from the lower deck. There are two other systems of promotion open to the lower deck, one for "upper-yardmen," that is, specially selected men who aspire to become admirals ultimately. The other is a

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"hostility measure" whereby promising men are selected (this is one of the responsibilities of the commander and officers of divisions) for commissions, after a period of specialized training, as Royal Naval Volunteer Reserve Sub-Lieutenants (Chapter 3).

Two of the titles borne by warrant officers go back to remote antiquity; they are the boatswain, and the carpenter, or as the latter is called today, the shipwright. The discovery of gunpowder introduced a third, the gunner. The invention of the torpedo, a fourth, the torpedo gunner. Steam swelled their ranks by a fifth, the warrant engineer, and signals, a sixth, the signal boatswain. And that, for a couple of decades, satisfied the immediate requirements of the always notably conservative Navy.

To keep pace with the scientific development of the Navy and to meet the aspirations of the men themselves, warrant rank was gradually introduced into all departments and crafts. Ordnance and electrical artificers, telegraphists, sick-berth stewards, writers, supply ratings, can all become warrant and commissioned warrant officers, and as such are indispensable links between the heads of departments and the craftsmen and technicians of these departments. Schoolmasters always enter the Navy with the rank of warrant officer.

OFFICER OF THE WATCH

The officer of the watch is the commander's mouthpiece, but he is vested with the authority of the captain when the ship is in harbour. In peace time he wears a frock coat and a sword belt and carries a telescope as symbols of his office. In time of war he wears a monkey jacket

Of warrant officers in general it might be said, more than of any other officer afloat, that they never give an order that they cannot carry out themselves. They are men of their hands and men in authority. They have been through the

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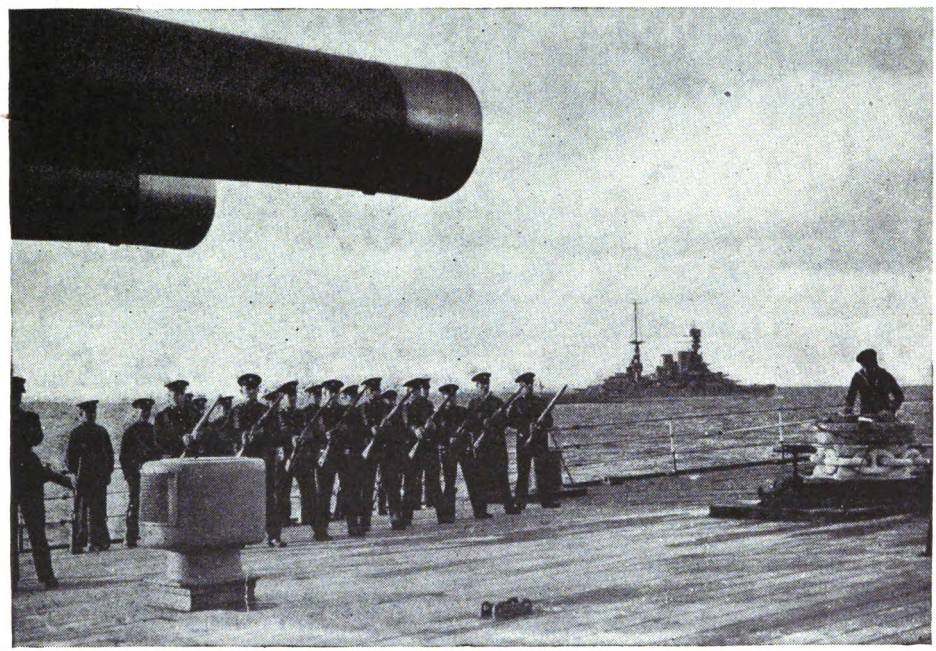
lower deck and it has no secrets from them. A "bird" might bluff the officer of the watch, he might conceivably bluff the commander, but he would never in a month of Sundays bluff the boatswain.

The warrant officer usually remains a commissioned warrant officer, although he can ultimately attain lieutenant's rank. He selects this limited method of advancement because he is content with that particular status; it may be that for domestic or private reasons he is reluctant to commit himself to the rather more expensive mode of life involved by further advancement, or he may dislike its social or ceremonial obligations. Whatever his motives for becoming a warrant officer, he remains one of the unchanging essentials of the Royal Navy's organization; he is one of the supporting pillars without which the house cannot stand.

Chapter 4 deals in detail with the Royal Marines, but because they play such a large part in the life of the ship and the tradition of the Navy we must glance at some of their activities on board before passing on to the administrative side.

ROYAL MARINES

By ancient tradition the Marines mess between the officers and the rest of the ship's company. They provide crews for a third of the ship's main armament, and all ceremonial guards. They act as sentries, and as attendants to ward-room officers, they furnish the orderlies, postmen and butchers. Technically, they cannot be ordered aloft: it is about the only thing they cannot be ordered to do in the certainty that they will "deliver the goods." Ship discipline is strict enough: by comparison with that of the Royal



ROYAL MARINES AT DRILL

The Marines provide crews for a third of the ship's main armament, and all ceremonial guards. By ancient tradition of the Navy their mess is situated between the officers and the rest of the ship's company. When landings are made the Marines form the spearhead of the attack

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Marines' parade ground ashore it is almost happy-go-lucky. We have seen that landing parties are largely the Marines' affair. In their nature these are pretty desperate undertakings, and to be effective call for super-discipline.

Marines' training has fitted them for a wide range of responsibilities, from posting a sailor's love letters to fighting a rearguard action against incredible odds, as in the evacuation of Crete. Afloat, they can man a triple 14-in. gun turret, darn a sock, race a 14-oared cutter against a crack seaman's crew and give them a drubbing, guard a rum barrel, and furnish a string band. Subalterns take their turn as officer of the watch in harbour. Their captain drills his detachment on a heaving deck as ruthlessly as on a parade ground.

PAYMASTER BRANCH

The administrative side of ship organization falls into two classifications: materiel and personnel, which can be translated as things and people. A man-of-war is not only a mass of machinery of one kind and another, but carries on board stores and spare parts for the maintenance of these machines. Apart from its mechanical functions it also requires certain stores common to all ships—paint, ropes, steel hawsers, canvas, timber and the like. In the old days, in fact until the conclusion of the war of 1914-18, the ship's stores, except the engineer's outfit, were the responsibilities of the warrant officers—the gunner, the boatswain and the carpenter. They kept their books and carried out all store accountancy in their cabins in their spare time, and how they did it with no clerical training, no staff to assist them, and their day taken up with technical duties, is "nobody's business."

The multiplication and complexity of stores and spare parts called eventually for a properly organized system of storekeeping. The whole responsibility for all naval stores afloat, except ammunition and explosives and oil fuel, then devolved on the paymaster. There is not space to go into details of the material side of the paymaster's duties. It suffices that he has charge of all stores, tools, and spare parts on board. In a battleship this comprises about 10,000 items. They are what the Navy calls "on his slop-chit," the implication being that if he loses anything he has to pay for it out of his own pocket. Now we must review his other duties, which are concerned with personnel, and can be grouped under the headings of pay, food and clothing.

Officers are paid monthly, and ships' companies are paid fortnightly. By custom of the Service all ratings below petty officer remove their caps on being paid. Pay accounts are calculated in ledgers, a double entry system of accountancy. The ledgers are kept by writers, a naval equivalent of clerk or accountant. Besides what a man draws at the pay table, a portion of his pay is allotted to his dependants through the Admiralty. He can also remit a part to the Post Office Savings Bank. There are special allowances for good conduct badges, upkeep of kit, for "temperance men" who do not draw their daily tot of rum, and for performing unusually arduous tasks such as painting interiors of double-bottoms. There is, of course, marriage allowance, and there are various gratuities.

THE SHIP'S CASH

Cash is kept by the paymaster (in a battleship his rank would be that of paymaster-commander) in a safe under a sentry's charge. He himself keeps the keys perpetually on his person day and night: they make uncomfortable bedfellows indeed.

There are two systems of messing in the Navy. One is a standard ration of meat, bread and vegetables, tea, etc., supplemented by a money allowance, so

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PREPARING MEALS FOR A THOUSAND MEN

Food is prepared in a battleship by the cook's staff. It is cooked in huge oil-fired galleys and is served out "piping" hot to the various messes from steam or electrically heated cupboards

Breakfast	Dinner	Tea	Supper
Bacon and egg	Tomato soup, roast pork, apple sauce, cabbage and potatoes, stewed apples and custard	Rock cakes	Fried fish, chipped potatoes

that messes can buy their further requirements from the canteen. Under this arrangement every mess is a law unto itself. It has drawbacks from the cook's point of view, because he has so many different kinds of dishes to accommodate on his range. It is confined to small ships, such as destroyers and below.

In our battleship, however, there is a general mess system. The paymaster-commander prepares a menu weekly for the whole ship for each day of the week, and chief petty officers, petty officers and the "broadside" messes all feed alike. Opposite is a specimen average menu.

When it is remembered that there are 1,500 men on board and that a ship may be fourteen days without an opportunity of replenishing stores, the scale of the stores carried to maintain this standard of meals for a long period at sea can be the more readily realized.

FOOD AND CLOTHING

Food is prepared by the cook's staff, and when cooked is issued to the messes from electrically or steam-heated cupboards. All bread is baked on board. In action sandwiches and hot drinks are prepared by the cook's staff and distributed to the quarters. Rum is issued daily to all men over twenty; the ration is half a gill, diluted with an equal part of water. Chief P.O.s and petty officers

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draw their rum neat. About two-thirds of the ship's company are "temperance men"; this proportion has remained curiously constant over the last decade.

Stocks of clothing are carried on board and issued weekly on a cash payment basis. In naval parlance they are called "slops." Serge is issued to men who choose to have their trousers and jumpers made on board. This is usually called a "square rig." There are "jews"—i.e., tailors—among the ship's company who make up the material into garments at approved rates. The term is a survival from Nelsonian days when tailoring ashore was largely in non-Aryan hands. Chief P.O.s and P.O.s who wear a "fore-and-aft rig," i.e., double-breasted or single-breasted jacket, are measured and their suits made by shore tailors under contract. Boot repairs are carried out on board by a "snob" or shoemaker, on the same lines as "jewing" is done. Small approved "dhobie" (an East Indian word) firms do a certain amount of laundry, but most men wash their own garments in their spare time.

ACCOUNTANCY

The accountancy connected with food and clothing and naval stores is carried out by supply ratings, chief petty officers, petty officers and assistants, under the immediate supervision of a warrant or commissioned supply officer. Similarly the accountancy may be overseen by a warrant writer, with corresponding grades of writers to assist him.

IN THE PETTY OFFICERS' MESS

Chief petty officers and petty officers mess separately in enclosed or curtained messes. The remainder of the ship's company occupy "broadside" messes, twelve or sixteen to a mess. Boys mess separately under the supervision of a petty officer. P.O.s and "broadside" messes feed alike

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The paymaster-commander has also a lieutenant-commander, lieutenants, sub-lieutenants and midshipmen as his assistants. They can be recognized by the white strips of cloth on their sleeves, between the rank stripes.

The normal health of a ship's company is good: considerably higher than a community of a corresponding number ashore. There is, however, a greater percentage of minor accidental injuries. The sick bay on board a battleship comprises a consulting room and dispensary, a ward with an isolation compartment, an operating theatre, X-ray room, and dental surgery. When the ship is in harbour, serious cases are, of course, sent to the nearest hospital ashore.

In action, the medical officer organizes medical distributing stations in different parts of the ship to which wounded can be removed by trained stretcher parties. The medical officer has assistant surgeon-lieutenants and one or more dental officers under his orders. The actual tending of the sick, dispensing, massage and nursing, is performed by sick berth stewards, who have corresponding rank to all other branches, i.e., chief sick berth steward, sick berth petty officer, leading sick berth attendant and sick berth attendant. Some are specialists in X-ray or massage. Warrant rank is open to them, but wardmasters, as warrant sick berth stewards are called, serve principally in naval hospitals ashore.

THE RUM ISSUE

Rum is issued daily to all men over twenty. The ration is half a gill, diluted with an equal part of water. Chief petty officers and petty officers are permitted to draw their rum neat

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LEISURE MOMENTS IN THE STOKERS' MESS

The men sleep in hammocks slung over their messes. In daytime hammocks are lashed up and stowed in racks. These men are having a game of cards before "pipe down" sounds at 10 p.m.

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TYPICAL SCENES OF DAILY LIFE

There is always work to be done and watches to be kept in a man-of-war. Some of the daily duties in a sailor's day are portrayed in the composite photograph above. Above, (left)

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ABOARD A BRITISH BATTLESHIP

sailors are hauling an anchor cable and (right) scrubbing the decks. Below are (left) a look-out in the crow's nest, (centre) a sailor being paid and (right) a reading being taken on a sextant

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THE CHAPLAIN

The chaplain holds no rank other than that of his office, but he is always accessible and ready to give a word of comfort or advice

Assisted by one or more schoolmasters (warrant rank) the instructor officer (who may be an instructor-commander or lieutenant-commander) carries out all the scholastic education on board. Apart from the mathematical and navigational training of midshipmen, there is routine school for boys and special classes for men qualifying for advancement and high educational tests.

Instructor officers receive training in meteorology and act on board in the highly important capacity of weather prophets, or meteorological advisers to the captain. This is of particular importance when operations take place involving the employment of aircraft. The instructor-officer is commonly employed in action, plotting the ship's position with its frequent alterations of course and in this he acts in the capacity of assistant to the navigating officer.

CHAPLAINS

Most capital ships have a small space between decks set aside as a chapel, frequently beautified by the voluntary labours of the ship's craftsmen. Here the chaplain holds religious services other than the morning prayers and Sunday "Church," which take place on deck; men can use it when they feel in need of a few moments solitude and peace.

Apart from his purely religious duties the chaplain is always accessible for advice. Divisional officers are always similarly accessible to their divisions, but sometimes men who find themselves in perplexity prefer to go to the padre; this is particularly the case in war, when a proportion of the ship's company are "hostility" ratings, unfamiliar with the divisional system. In some cases the chaplain acts on his judgment: others he refers to the man's divisonal officer or the commander. In exceptional circumstances he may even refer a man's case to the captain himself.

It may be a youngster has lost his mother and wants a few hours' privacy for his grief. The padre's cabin is his to be alone in. There are troubles of every kind that war and human error can introduce into sailors' lives, and to these, irrespective of creed or rank, the chaplain is guide, philosopher and friend. He has no "rank" other than his office. A ship in each squadron carries a Roman Catholic chaplain, who shares the ship's chapel with the Church of England padre. The chaplain also identifies himself with sports and recreations, of which more will be said later on.

A battleship's complement is divided into divisions, as follows: seamen, stokers, engine-room artificers, artisans, accountants, torpedo-men, Marines and boys. The seamen are subdivided into three

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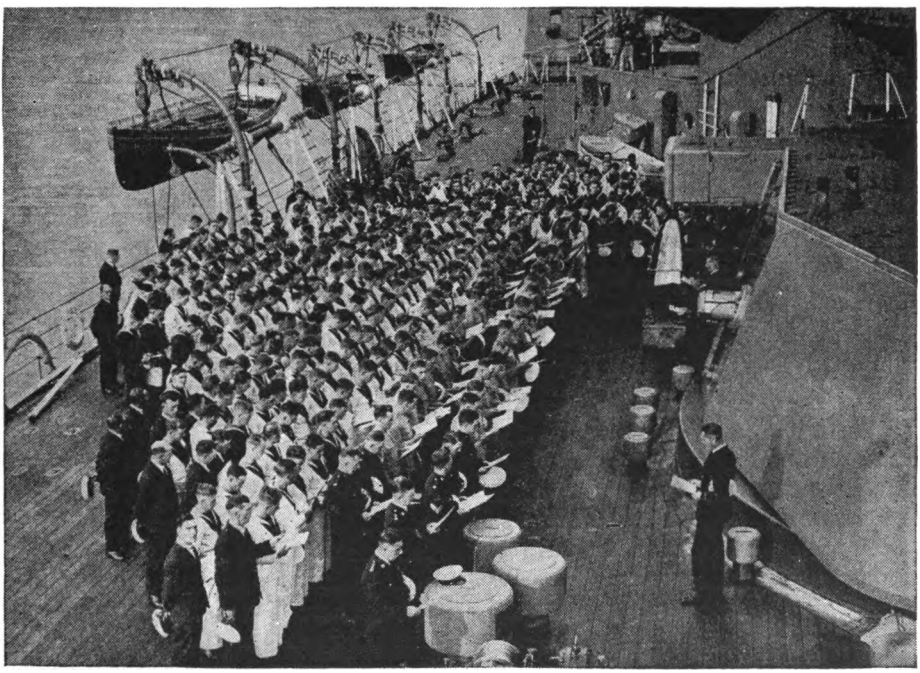
divisions: forecastle, top and quarter-deck. The sailing-ship organization necessitated four, forecastle, fore-top, main-top and quarter-deck. Masts were then the governing factor; now it is turrets, of which the seamen provide crews for three, and Marines the fourth. Their messes or living-quarters correspond roughly to the positions of their turrets.

SUPERVISION OF MESSES

Rank and command is in a descending scale from chief petty officer to petty officer, leading seaman to able seaman, ordinary seaman to boy. These ranks, or their equivalents, are common to all departments. Ordinary seaman and boy are, however, peculiar to the seaman branch; except in the Naval Air Arm there is no equivalent rank in any other branches lower than able seaman.

All divisions occupy separate mess decks which are under the supervision of the divisional officers. Chief petty officers and petty officers mess separately in enclosed or curtained messes. The remainder occupy "broadside messes," twelve to sixteen in a mess. Boys mess separately under the supervision of a petty officer.

The mess arrangement of today is very much the same as it was in Nelson's time, comprising a deal table with wooden benches, at right angles to the ship's side, a rack for crockery and another for ditty boxes. Men sleep in hammocks slung over their messes. In the daytime these hammocks are lashed up and stowed in racks. There is no privacy and yet there is no jostling.



MORNING PRAYERS

Morning prayers and Sunday service are held on deck, but most capital ships have a small space set aside as a chapel between decks where the chaplain holds religious services or where men can go when they feel in need of solitude and peace. This is known as "Church Place"

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AT HIS ACTION STATION

This sailor, standing at his action station beside his gun, is a typical example of the men who fight our ships, whatever the odds, and maintain the best traditions of the Service

The community seems to live in a disciplined equilibrium of mutual tolerance, respect for human dignity and Anglo-Saxon reasonableness: the junior steps aside for the senior, the man with a burden has right-of-way, the contents of a ditty box are sacrosanct. Centuries of sea tradition have bred in seamen a peculiar code of living together in ships; it has evolved like the rule of the road in cities. The alternative is confusion, discomfort and misery.

The personnel of a battleship in wartime differs considerably from that in peace. War recalls pensioners and reservemen from shore life, and introduces a number of men called up by age groups from civil life, or volunteers. This involves continuous training classes. It also increases the responsibilities of petty officers and leading seamen who are called upon to guide and instruct novices in naval tradition, language and usages which, in peace time, they would gradually absorb in training establishments over a much longer period than is possible in time of war.

It further complicates the task of the officers of divisions, who find among the lower ratings a wider range of ages, intelligence and social background than the Navy has known before. An ordinary seaman may be eighteen or in his thirties, he may have a university science degree or have had his schooling from a gipsy caravan; he may be heir to a baronetcy, or be a Barnardo foundling. The *tempo* of training and discipline on board has to be adjusted accordingly; tuned, as it were, to a mean between all these extremes. Mere barrack-yard discipline would achieve nothing but spiritless obedience and a large punishment return which would impair efficiency and damp enthusiasm. Contentment and enthusiasm can only be ensured by a close, happy understanding between officers and men, by mutual trust and liking. In these relationships, recreation plays a large part

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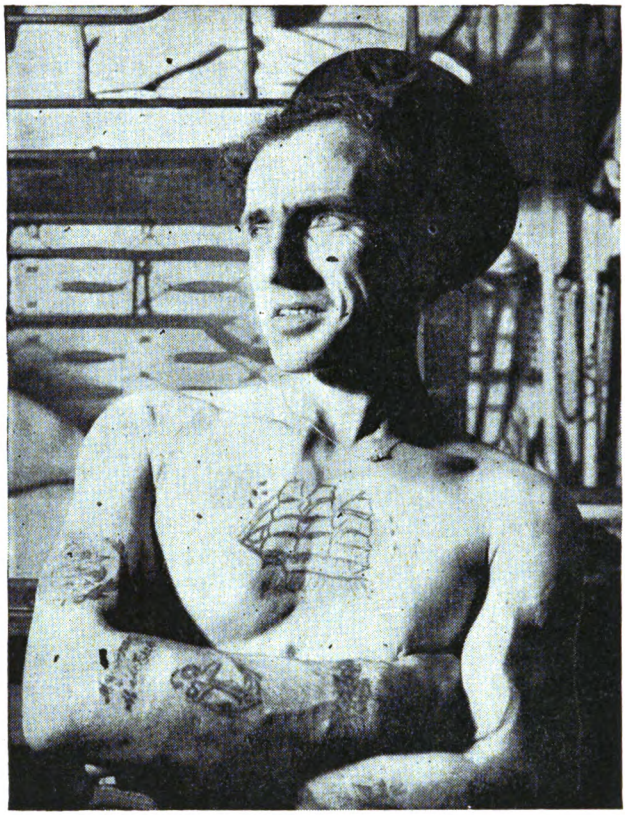
When in harbour there are usually facilities ashore for sport—football, cricket, hockey, perhaps dances and social entertainment. The sports officer makes the arrangements when there are teams among the residents ashore. In the absence of these, inter-divisional matches are arranged.

Except during the period of a refit, spells in harbour are as a rule brief and infrequent under war conditions. A ship then falls back on itself for its own amusement. A lesson well learned in the last war was the necessity for giving men an opportunity for a harmless "flutter" on a game of chance. This introduced "Tombola," a game something between fan-tan and a football pool. It can be played by hundreds of men at a time; it is run by a committee of chief petty officers under supervision of an officer; stakes are strictly limited to a few pence, and the prize perhaps £3 to £4, naturally varies according to the number playing.



"DÉSHABILLE OF LEISURE"

Sailors love ornaments and bright colours. That is why so many of them, like the able seaman above, are tattooed on their arms and chest with intricate and ornate designs

QUIZ COMPETITIONS

Another popular amusement consists of "Quiz" competitions between teams of officers and men. The contests takes place at a microphone and are relayed to the mess decks so that the whole ship's company can participate. As an example of the type of "Quiz" propounded, a team of chief petty officers asked an officers' team the number of steps from a certain pom-pom position to the compass platform. The officer challenged shut his eyes and climbed the ladder in his imagination. He had done it so often in the dark that he gave the correct answer.

The cinema, lectures by officers and men, darts competitions, the library, fit in somewhere in a busy life of instruction or instructing, of tricks at gun or look-out, duty in workshop, office or machinery space, of washing clothes and writing letters, meals and sleep. The whole company is, in fact, a busy yet happy family.

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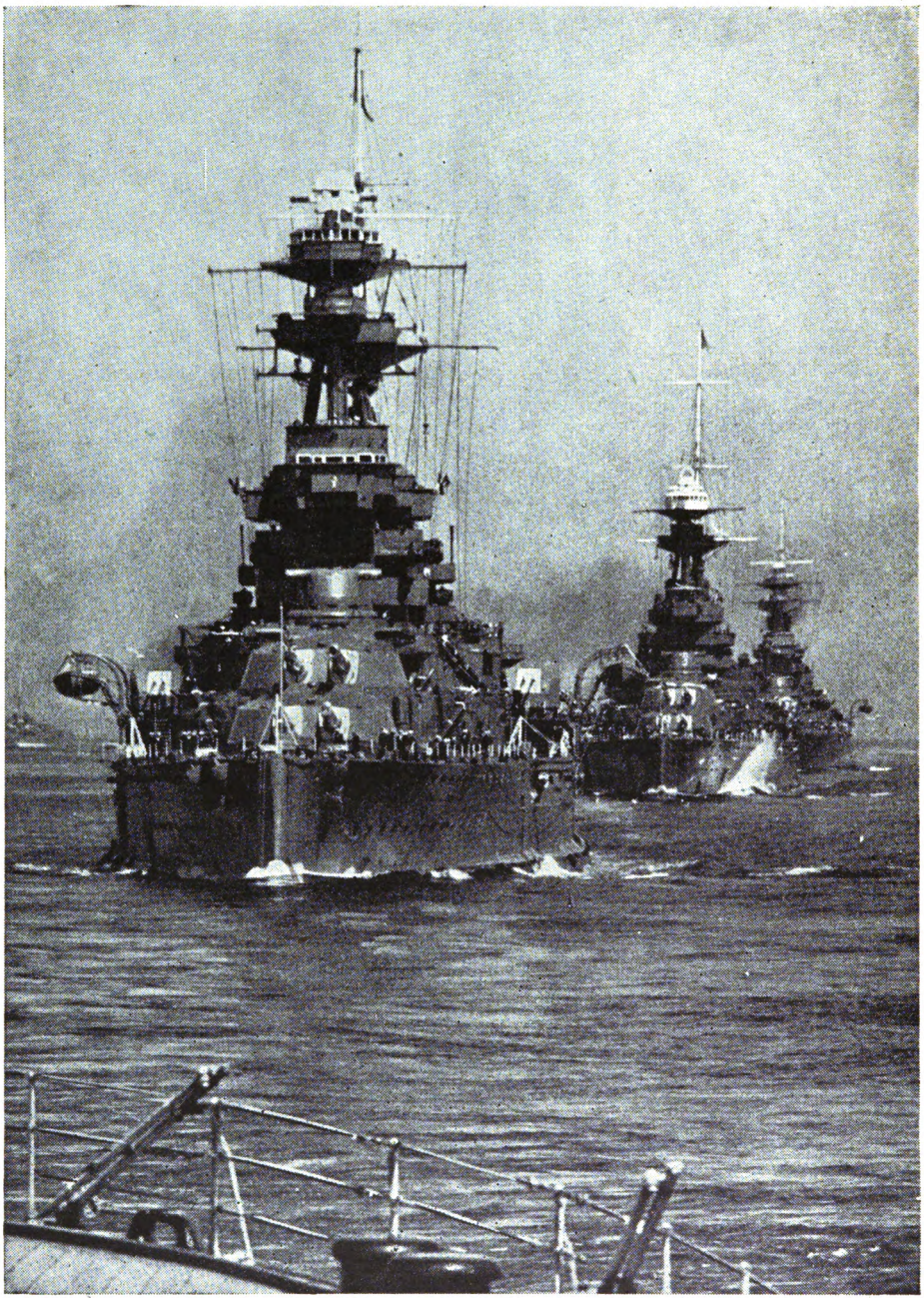

BATTLESHIPS IN LINE AHEAD

The strength of any fleet depends in the end upon the number and power of its capital ships. Efficiency in the command of them is therefore a very vital matter of naval organization

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CHAPTER 3

The Command of the Navy and Its Ships

Board of Admiralty. The First Lord. Permanent Secretary. Controller of Merchant Shipping and Repairs. Committee of Imperial Defence. Vice-Chief of Staff. Speed of communications. "Fighting Instructions." Red light of warning. Cabinet control. Significance of the flagship. Entry of cadets. How promotion is gained. Admiral of the Fleet.

THE Admiralty is in command of all naval commanders-in-chief, and is responsible to the King and, through Parliament, to the Nation for the conduct of naval affairs. Its word is law, and is embodied in *The King's Regulations and Admiralty Instructions for the Government of His Majesty's Naval Service.* The Board of Admiralty is appointed by the King. Formerly the whole Board was drawn from members of Parliament; nowadays the naval members are released from the necessity of obtaining a seat in the House and of belonging to the political party in power.

The First Lord of the Admiralty is chosen by the Prime Minister from amongst his political colleagues, and becomes a member of the Cabinet. If not already a member of the Privy Council, he is appointed one by the King and proceeds to form his Board; the whole Board is then appointed by the King, by Royal Letters Patent, to be commissioners for executing the office of Lord High Admiral.

The Board consists of three political members who bear the responsibility in Parliament and on the public platform; and a number of professional members who include the Sea Lords, the Permanent Secretary of the Admiralty, and possibly technical civilians who may be appointed to the Board in special circumstances but are not members of Parliament. Thus the Prime Minister informed Parliament during the Second World War that the Government had decided that the Admiralty should become responsible for merchant shipbuilding and repairs, and that a technically competent civilian would be appointed to the Board of Admiralty as Controller of Merchant Shipbuilding and Repairs.

VICE-CHIEFS OF STAFF

In the Cabinet the First Lord of the Admiralty is responsible for naval advice. In peace, the Cabinet delegates the detailed consideration of defence matters to a Cabinet Committee, called the Committee of Imperial Defence, which in war becomes merged into the War Cabinet. In attending the Committee of Imperial Defence the First Lord is accompanied by his chief professional adviser, the First Sea Lord and Chief of the Naval Staff; and the other Service Ministers are also accompanied by their chiefs of staff. But in the Second World War it was found that air warfare alone necessitated all three Services working a

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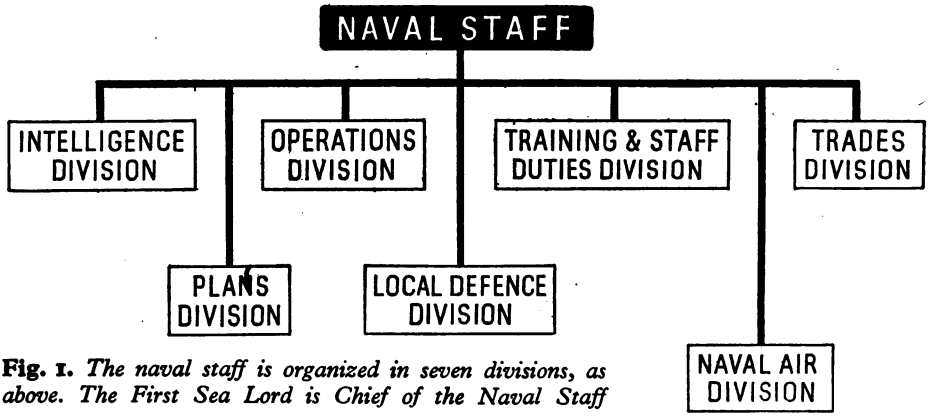

Fig. 1. *The naval staff is organized in seven divisions, as above. The First Sea Lord is Chief of the Naval Staff*

twenty-four hour shift, with consequent strain on the chiefs of staff. To relieve that strain the Government appointed vice-chiefs (or deputy-chiefs) of the staff in all three Services, to represent their respective chiefs of staff either at meetings of the War Cabinet or at Board meetings in their own departments when their chiefs of staff were unable from any cause to be present.

In Parliament the First Lord is assisted in the conduct of naval business by the Parliamentary and Financial Secretary and by the Civil Lord. They present the Navy Estimates and conduct them through the House, and answer all inquiries relating to the Navy.

SUPPLEMENTARY COMMITTEES

At the Admiralty, the Board meets as necessary; but during the war of 1914-18 it was decided to supplement the meetings of the full Board by smaller meetings, for which purpose the Board was divided into two committees, one Operational, the other Maintenance.

At the Admiralty the First Lord has the general direction and supervision of all business, and each of the other Lords Commissioners is charged with the superintendence of certain blocks of business in addition to his general responsibility for the whole as a member of the Board. The Financial and Parliamentary Secretary is, as his title implies, concerned with finance. The Civil Lord has the superintendence of works and civil establishments. The Permanent Secretary is the accounting officer for Navy Votes, and has also general control of all the civilian departments (*see* Fig. 2).

The duties of the Sea Lords are indicated in their supplementary titles. The First Sea Lord and Chief of the Naval Staff bears responsibility for all large questions of naval policy and maritime warfare. He is assisted by the vice-chief of the naval staff, and under him the assistant chiefs of naval staff whose numbers will increase in wartime. The chief of the naval staff, the vice-chief, and the assistant chiefs form the Operational Committee of the Board.

The Second Sea Lord and Chief of Naval Personnel is responsible for the manning and training of the fleet. The Third Sea Lord and Controller is responsible for the provision of material, whether of ships or their armament. The Fourth Sea Lord and Chief of Supplies and Transport is responsible for the supply of naval stores, provisions and the like, besides superintending the Transport Service. The Fifth Sea Lord and Chief of Naval Air Services is responsible for the Naval Air Arm.

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Under each Lord are grouped the various Admiralty departments which are each responsible to their superintending Lord. The departments bear names which are explanatory of their work.

THE NAVAL STAFF

Under the First Sea Lord is the naval staff which, on the outbreak of the Second World War, was organized in seven divisions, each under a director. They were the naval intelligence, plans, local defence, trade, operations, training and staff duties, and naval air divisions. During war the number of divisions increases, and sections within divisions become of such importance as to justify their being created separate divisions (*see* Fig. 1).

The naval staff is superintended by the First Sea Lord as Chief of the Naval Staff, assisted by the Vice-Chief of the Naval Staff, and under them the assistant chiefs of the naval staff. The First Sea Lord has the superintendence also of the department of the Hydrographer of the Navy, whose work includes the surveying of the seas and the publication of charts, sailing directions, tide tables, light lists and notices to mariners.

Under the Second Sea Lord are the departments concerned with the personnel of the fleet. These are the departments of the Directors of Personal Services, Naval Recruiting, Physical Training and Sports, and Education, the Medical Director-General, Paymaster Director-General,

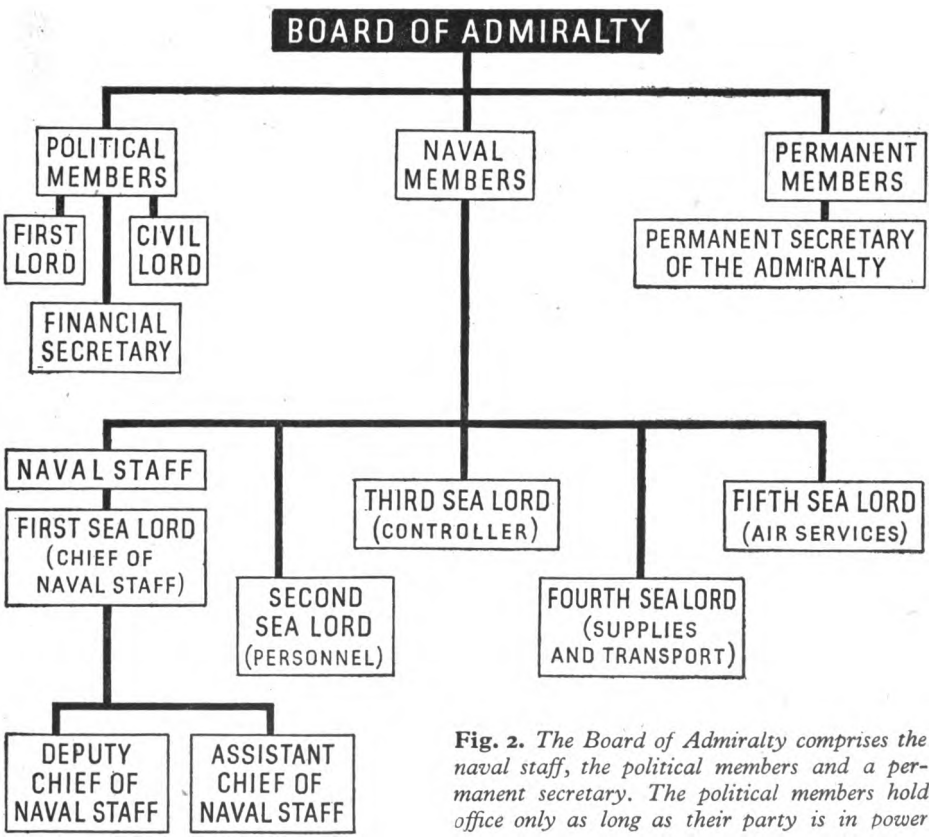

Fig. 2. *The Board of Admiralty comprises the naval staff, the political members and a permanent secretary. The political members hold office only as long as their party is in power*

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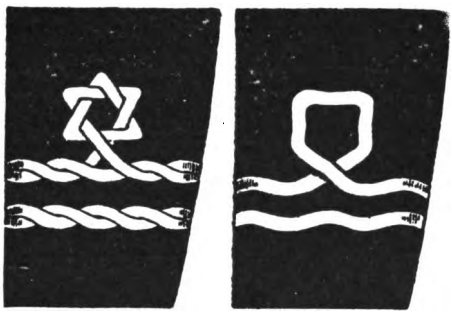
Chaplain of the Fleet, the Royal Marine Office and the Admiral Commanding the various Naval Reserves.

Under the Third Sea Lord are the departments concerned with the material of the Navy. They are those of the Directors of Naval Construction, Dockyards, Electrical Engineering, Naval Ordnance, Armament Supply, Torpedoes and Mining, Naval Equipment, Compasses, Signals, Scientific Research and Experiment, and the Fleet Engineer-in-Chief. These departments cover the whole of the work involved in building, equipping and repairing warships.



R.N.R. AND R.N.V.R.

Fig. 3. *Officers in the R.N.R. and R.N.V.R. may be distinguished by their gold lace sleeve bands. Above are shown those of a lieutenant (left) R.N.R. and (right) R.N.V.R.*

Under the Fourth Sea Lord are the Naval Store Department, which provides oil fuel, coal and other stores; and the Victualling Department, which provides food and clothing for the fleet.

In wartime, reasons of security prevent the disclosure of the information which the Admiralty publishes in peace time. But in normal times the expenditure on the Navy is set out in great detail in the Navy Estimates which are annually presented to Parliament, and under one of the Votes (Vote 12) very full information is given of the organization of the Admiralty Office. This information is supplemented by the Navy List, a publication which gives the names of the naval officers and civilians serving in the various departments of the Admiralty.

A "Board" meeting is theoretically attended by all the members; but it can also consist only of two Lords and a secretary, a convenient delegation of authority on the part of the full Board. In this way Board sanction can be given to a number of more or less minor matters which, although coming under the category of subjects that have to obtain Board sanction, are not of sufficient interest to warrant the summoning of a full Board. It is possible, and not infrequently happens, that two Boards may be sitting hundreds of miles apart at the same time. Especially is this the case when the First Lord is absent on a tour of inspections in the Admiralty Yacht, as at any time he may be.

Approval can be given to weighty matters, say at Plymouth or even Malta, while the ordinary business of the Admiralty is able still to progress at Whitehall. It is not necessary for the minor Boards to meet, it is sufficient for the papers to pass and the signatures to be obtained, which is a commonsense and time-saving arrangement.

The Board Room in the old Admiralty building is a handsome oak-panelled room decorated with carvings by Grinling Gibbons and a fine portrait of Nelson. On one wall is a large indicator, showing the direction of the wind, which was worked by the main weathercock on the roof of the building; an instrument of prime importance in the days of sailing ships, for on the showings it registered important decisions might depend.

Important decisions, indeed, were taken in that room around the old table, decisions which for two hundred years closely affected the interests and fate of our country. Rumour, fed by traditions, whispered that bottles of port wine as well as weighty affairs were discussed in the old days at that piece of mahogany

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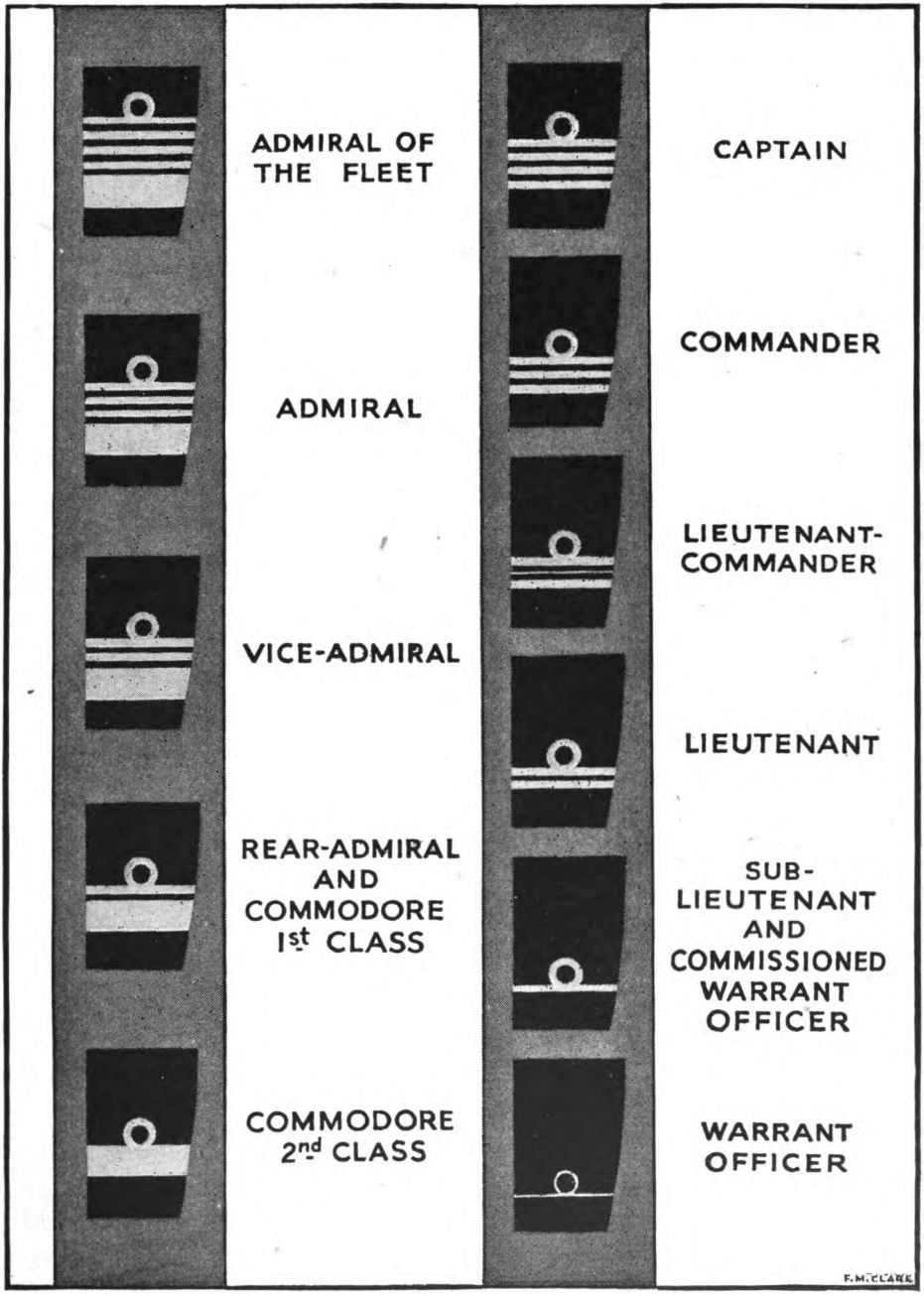

RANK IN THE ROYAL NAVY

Fig. 4. *The ranks of naval officers are indicated by the gold lace on their sleeves. Accountant, engineer and medical officers respectively have white, purple and red bands between the stripes*

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on many a dark and foggy afternoon. Time then was of small relative importance to what time means in these days. Then a message from the Mediterranean might well take a month or more in transit; and even after it had arrived in this country it had to travel by post-chaise from Falmouth up to London. Now the commander-in-chief in the eastern waters of that sea can hear Big Ben strike actually before the stroke is heard by their lordships in Whitehall.

SPEED OF COMMUNICATIONS

The telegraph—that is, the semaphore communication between the Admiralty and the home ports—was then the most rapid means of conveying orders and news. This comprised a number of stations within visual distance of each other, each provided with a large semaphore. Naturally, such communication was subject to interruption in bad and thick weather, and even in clear weather transmission was none too rapid.

This matter of speed of communications has altered considerably the relations between the commanders-in-chief on foreign stations and the Admiralty. In olden times, say Nelson's period, an admiral had a far freer hand, and more diplomatic responsibility than in these days. Each man in command of a fleet or squadron had to act as seemed to him to be best in any emergency without reference to other commands or the Admiralty. His decisions had to fit into the general pattern of events as best they could, and not infrequently were bound in some ways to form rough patchwork. Now wireless and the submarine cable allow of immediate conference between the Admiralty and all naval commanders, therefore complete and neat dovetailing of all the jig-saw of current events results. Strategy can be unified in a way that never before was imagined possible. Speed has transformed operational matters.

In the sphere of tactics, matters remain much the same as before the days of wireless telegraphy. If we go back to the seventeenth and eighteenth centuries we find that the Admiralty mistook the solution of the problem how best to encourage the admirals to fight, and issued "fighting instructions" to the fleet. These laid down certain rules that were to be observed when fighting at sea. It is of course impossible to lay down any tactical regulations that will fit all circumstances, nor any that cannot be read in a manner different from that intended.

Moreover, they are bound to have the fatal defect of relieving an admiral of the responsibility of fighting his own battles in his own way. The result was disastrous. Admiral Mathews was court-martialled and cashiered for disobeying the fighting instructions, although he did the right thing. And Admiral Byng was court-martialled for doing the wrong thing although he stuck to the instructions. When he was called upon to make a tactical decision he elected to stick to the instructions: saying that he "was not going to make the same mistake that Mr. Mathews had done and disobey the instructions." For which, to save the official "face," he was shot. After that the Admiralty returned to reason cancelled the instructions, and have since, with one exception, avoided giving direct orders to an admiral while in action.

ADMIRALTY INSTRUCTIONS

That exception was during the war of 1914-18, when on one of the occasions that the enemy battle cruisers were making a tip-and-run raid, the Admiralty, without knowledge of the exact local weather, "ordered" instead of suggested to Admiral Beatty to steer in a certain direction, which was different from that which he and Admiral Jellicoe had decided on. The result was that the enemy was lost sight of in the thick

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weather and not brought to action. That was a slip-up on the part of the Admiralty, and is likely to be a red light of warning against any repetition.

MATTERS OF POLICY

The Board of Admiralty has a peculiar responsibility as regards the nation. The First Lord is a member of the Cabinet; the Naval Lords have no political leanings so far as their duties are concerned. They are quite independent but, at the same time, owe loyalty to the First Lord. Usually no differences of opinion arise on matters of policy. But, should these come along, the First Lord has the right to ignore the advice of the members of the Board and to decide the matter according to his views and not theirs. Naturally, should this happen, the naval members of the Board are free to decide whether the matter is of sufficient importance to warrant their resignations. It is one of those matters where conscience is pitted against loyalty, and also, the members being human, their own interests. For so grave a step might well jeopardize their future careers.

It is only on questions of the maintenance of the strength of the Navy that such an impasse is likely to arise, and this may take one of two forms. The Government may adopt a policy like that unfortunately taken some twenty years ago by those in power in this country, based on the assumption that there was to be no more war, that lions and lambs were in future to lie down together when so ordered by the League of Nations, therefore Britain could practically disarm, and the promises of foreigners were better safeguards than those provided by a strong navy. Or the Government might merely seek to pare down the Navy estimates in order to obtain money to spend in other, and more politically fruitful, and from the Navy point of view much less useful, directions.

The country has a firm belief in the integrity and single-mindedness of the representatives of the Navy at the Admiralty. It believes that the naval members will, if necessary, hoist the only danger signal that they can (for, of course, their lips are sealed), and resign if the Navy was being seriously let down.

The responsibility under such circumstances lies first of all with the First Lord. It is for him to decide whether he will support the Board or the Prime Minister. It is for him to fight the battle of the Navy in the Cabinet. A good example of such a fight is that when, in 1909, the First Sea Lord, Lord Fisher, drew the attention of the First Lord, Mr. Reginald McKenna, to the necessity for a considerable augmentation of our dreadnought battleship strength. The First Lord brought the matter before the Cabinet, where considerable opposition was experienced. This he fought so strenuously that for three days he was practically out of the government. If his resignation had been accepted by the Prime Minister, then Lord Fisher would have resigned, and his action, in all probability, would have been followed by that of the remainder of the Sea Lords.

NAVY AND CABINET

Such resignations would have been handed in, not to coerce the Prime Minister but to bring forcibly before the nation the fact that the Navy was being starved, and that the naval members could no longer accept the responsibility of office. Sir Edward Grey, the Foreign Secretary (later Lord Grey of Fallodon), took a hand in the dispute, the matter was again brought before the Cabinet, and the economists were routed. It is extremely probable that had it not been for Mr. McKenna's action we should have lost the war of 1914-18.

The case where it is the expressed policy of the Government to reduce the

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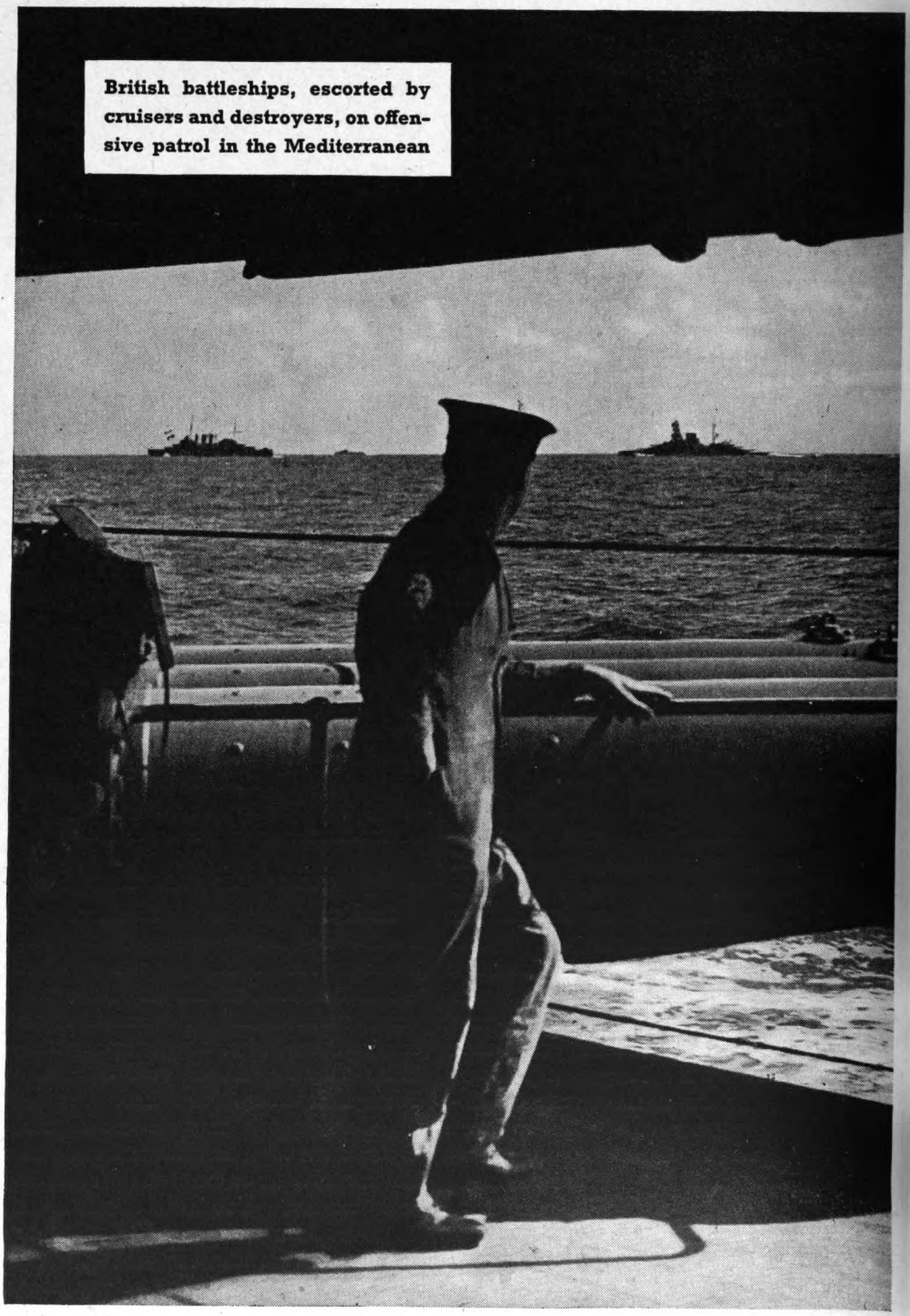

British battleships, escorted by cruisers and destroyers, on offensive patrol in the Mediterranean

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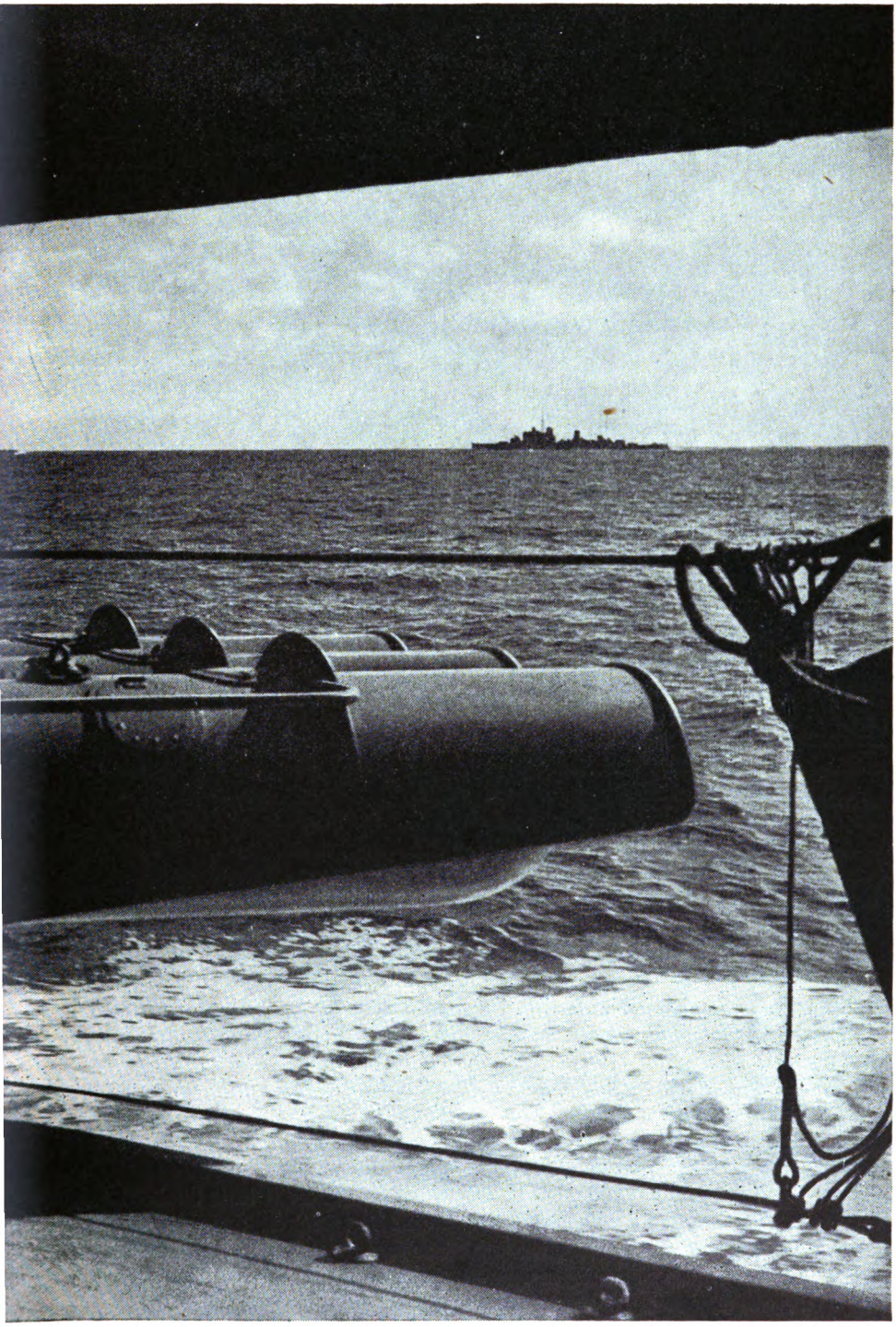

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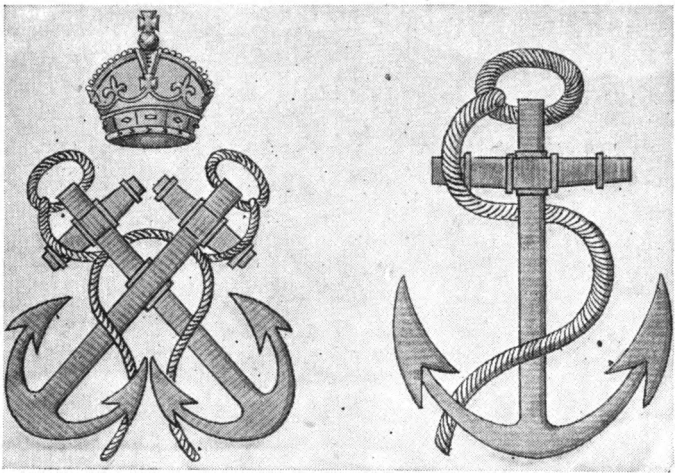

SUBSTANTIVE BADGES

Fig. 5. *Petty officers wear crossed anchors and a crown, and leading seamen an anchor, on their left arms. They are red on working-rig*

Navy to the level of impotence is more difficult for the First Sea Lord to deal with. Such a case arose when a wave of pacifism swept over the country round about 1930. Then the strength of the Navy in ships and, what was worse, in ammunition was brought to a dangerously low level. Was the First Sea Lord to go against a policy presumably acquiesced in by the Nation? The answer could only lie in the doubt whether the Nation really appreciated that the Navy was starved below its capacity to defend the country. If there had been the slightest reason to doubt that this was the case, the First Sea Lord should have resigned and left the country to decide if it wished to go to the fatal extreme and commit suicide.

RESIGNATION AS A WEAPON

Such a resignation would at all events have caused the nation to appreciate the position beyond any shadow of doubt. The precipice would suddenly have yawned at their feet and the shock might have caused in our people a return to sanity. One other case when the resignation of the Sea Lords nearly took place occurred in 1893, when the then Chancellor of the Exchequer made a statement in the House of Commons which purported to give the views of the naval members of the Board, but which was entirely incorrect. This was publicly corrected, under the threat of their resignations.

When a First Sea Lord has made up his mind to resign, however much he may wish for the active support of his naval colleagues, it is obligatory that he should refrain from any attempt to canvass for such backing. Anything in the nature of a cabal would be contrary to the discipline of the Navy. An example of this is worth recording. When Lord Fisher resigned in 1915, owing to a difference of opinion with the then First Lord, he strictly observed this cardinal principle. To quote from his *Life*: "Throughout this crisis Lord Fisher, as might be expected, acted with scrupulous correctness towards the First Lord and his naval colleagues. He did not inform the other Sea Lords of his resignation until twenty-four hours after it had been sent in to the First Lord; and only then because of the extreme inconvenience that was being caused by routine and other papers being held up awaiting the signature of the First Sea Lord or someone acting for him. Had Lord Fisher made the slightest overture to the other Sea Lords there is little doubt that they would have felt it their duty to resign also, seeing that they fully concurred in the stand that he was making on the subject of the Dardanelles."

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Two things are fairly evident—that the First Sea Lord and Chief of the Naval Staff is a very busy man, and that he holds a position of great responsibility both in peace and war. He occupies, so far as the other Sea Lords are concerned, the peculiar and undefined position of *primus inter pares*—chief among equals. He is consulted on all matters of doubt by the other Sea Lords, and his views accepted; but (and this is most important) he never interferes with the departments under the control of the other members. He should never disagree on paper with the views of another member of the Board without first discussing the matter with him, in which case a mutually satisfactory solution is usually found.

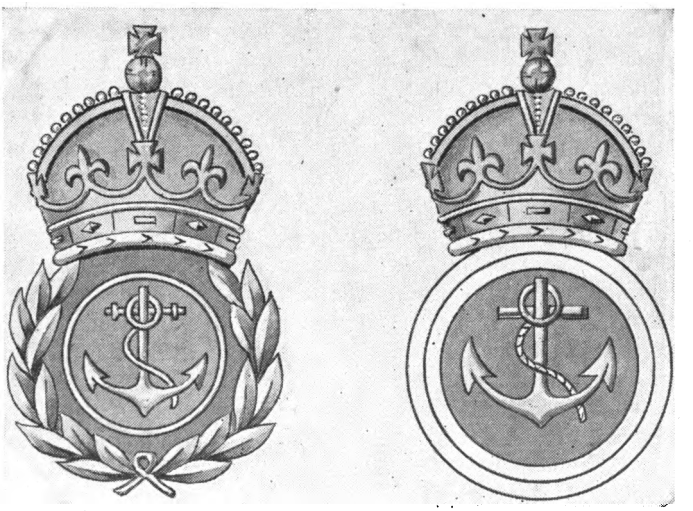
FIRST SEA LORD'S AUTHORITY

He also has a unique authority, in that no ship can sail and no gun can fire without his sanction. The First Lord, in these matters, can only work through him. Naturally, all such important decisions are the subject of Cabinet control, and before any step of international importance is taken the Foreign Office is consulted; but the executive orders that give effect to decisions must emanate from the First Sea Lord.

Provided the members of the Board stick to their own departments, and the First Lord does not interfere with the Naval work, the fact of having a civilian First Lord as head of a fighting force works well. That he should be a man of influence in the Cabinet and on good terms with the Chancellor of the Exchequer is of great importance to the Navy; but a weak First Lord is bad, and the evil effects consequent on his weakness are rapidly and deeply felt in all departments.

If the First Lord happens to be a member of the House of Lords, the importance of the post of Financial Secretary is greatly enhanced; since he has to steer the Navy Estimates through the House of Commons, and also answer the innumerable questions with which the representative of the Admiralty is usually bothered. Such questions are often asked more with a view to the embarrassment of the Admiralty than to obtain information. A clever fencer, but at the same time a man of transparent honesty, is a great asset, and of such men we have had several really good examples.

The Permanent Secretary, the direct titular descendant of Samuel Pepys, is a man of great importance inside Admiralty walls. Like all the heads of the Civil Service he is a key to the shafting that causes the wheels to revolve efficiently.



CAP BADGES OF NAVAL PETTY OFFICERS

Fig. 6. *The senior naval ratings are chief petty officers, then petty officers. They wear the badges shown respectively on the left and right*

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Having glanced at the organization of the Admiralty we can now pass on to consider the groups of ships called "squadrons," and groups of squadrons called "fleets," and see how they are governed and commanded, and their relationship with Whitehall.

INSTANT READINESS

Probably the most marked characteristic of a man-of-war is its instant readiness to go into action. It is no exaggeration to say that in times of profound peace any man-of-war at sea is ready, by day and night, to commence to fight, and able to fire the first gun within ten minutes of the bugle for action sounding. This is one of the old teachings of tradition and dates back to the days when any ship that was sighted might be an enemy, either national or piratical. The same applies to a ship in harbour. In peace time she is instantly ready to fight unless laid up for repairs or "out of routine"—that is, occupied in work which completely but temporarily suspends her normal activities.

Another distinctive feature is her ability to proceed at the shortest possible notice to distant stations, and to remain on them for long periods. If a man-of-war is required to proceed, say, from the Atlantic to China, all that is necessary is to order her to complete with fuel; after so doing she can sail without an hour's delay. During the process of fuelling she will fill her refrigerating chamber with fresh meat; she already has three months' preserved provisions on board. Her magazines and shell rooms are already filled, or may require only a few charges to replace those which have been expended in practice. That is all. This instant readiness and homogeneity of purpose is maintained in a fleet largely by the old-time practice of "following the motions of the flagship"—that is, whatever drill or operation the senior officer's ship may undertake or perform all other ships instantly follow suit. By this means all ships are kept in the same state of preparedness as that of the flagship for any service that may be required of them.

Incidentally also, this instant following of the doings of the senior officer impels the keeping of a sharp look-out on the part of every ship. If the doings of the flagship are not instantly noticed, a signal of reprimand will most certainly reward the unfortunate laxity of vigilance.

This naturally brings us to consider the admiral and his flagship a combination that acts the part of shepherd to the flock. Whenever two or more ships are in company, whether at sea or at anchor, the junior is automatically placed under the orders of the senior, who commands both ships as a single unit.

The word "fleet" can be applied to any number of ships under discipline and command. The British Fleet includes every ship in the Navy, as well as all the subsidiary vessels commandeered during wartime. The Mediterranean Fleet, for example, includes a battle fleet and cruiser squadrons, destroyer flotillas and submarine flotillas, as well as aircraft carriers of which there may be quite a considerable number, and other auxiliary ships.

FLEET'S COMPOSITION

The commander-in-chief commands the whole lot. The battle fleet is divided into divisions, the number depending on the number of ships, usually four in each division. Each division is commanded by an admiral, usually of vice but sometimes of rear rank. Each division of four ships is subdivided into two subdivisions each commanded by a rear-admiral. The squadrons are commanded by rear-admirals or commodores, the flotillas usually by commodores. The second-in-command of the whole fleet is the admiral

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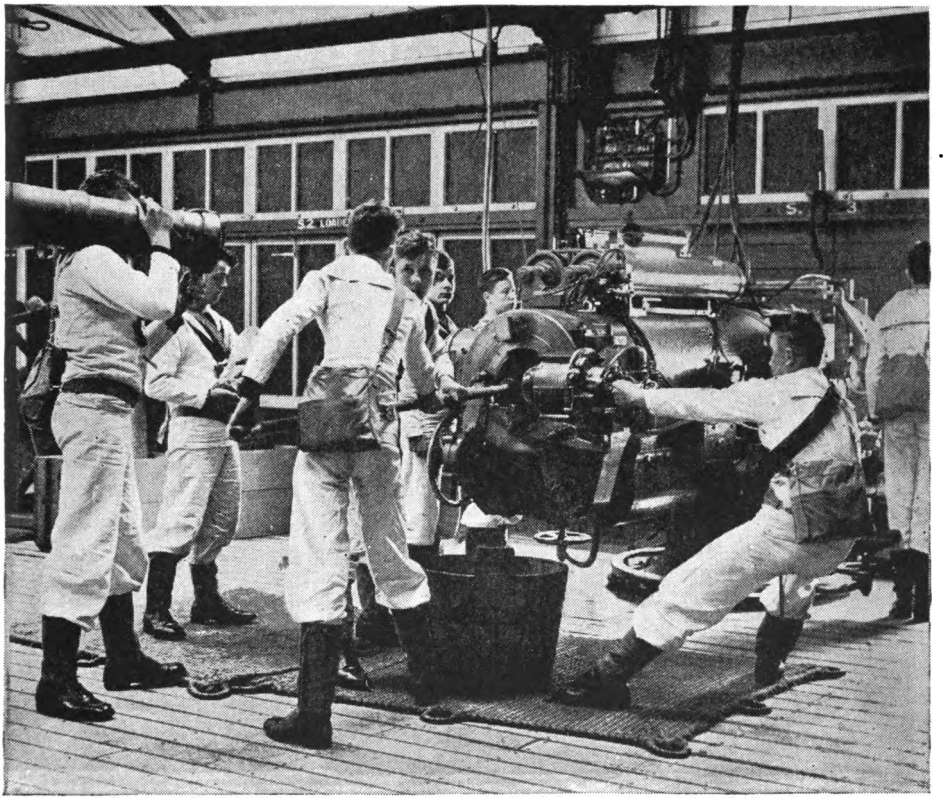
next in seniority to the commander-in-chief—usually the admiral in command of one of the several divisions of the battle fleet.

Let us pause here to consider how a boy or youth can enter the Navy and rise by sheer merit to be an admiral or even Admiral of the Fleet, in peace time.



TRAINING YOUNG NAVAL GUNNERS

Gunnery in the Royal Navy is a highly scientific matter. Gunners begin their training early, as the highest possible efficiency must be achieved. These boys are training as a 6-in. gun crew at one of the naval training establishments. The breech is being swabbed out before re-loading

In order to broaden the basis of entry of cadets into the Royal Navy, the Admiralty have initiated scholarships. These allow for the payment of the costs of education of the boys on a sliding scale. It is impossible here to enter into details. Suffice it to say that in the extreme case of parents being totally unable to contribute, the whole of the expenses are borne by the country, and, when necessary, sums are paid towards the keep of the boys in their homes during the vacations.

One of the two main systems of entry is when a boy reaches approximately thirteen and a half years. He then, on application to the secretary to the First Lord of the Admiralty, sits for an examination conducted by the Civil Service Commissioners, and if successful joins the R.N. College at Dartmouth. There, as a naval cadet, he remains for

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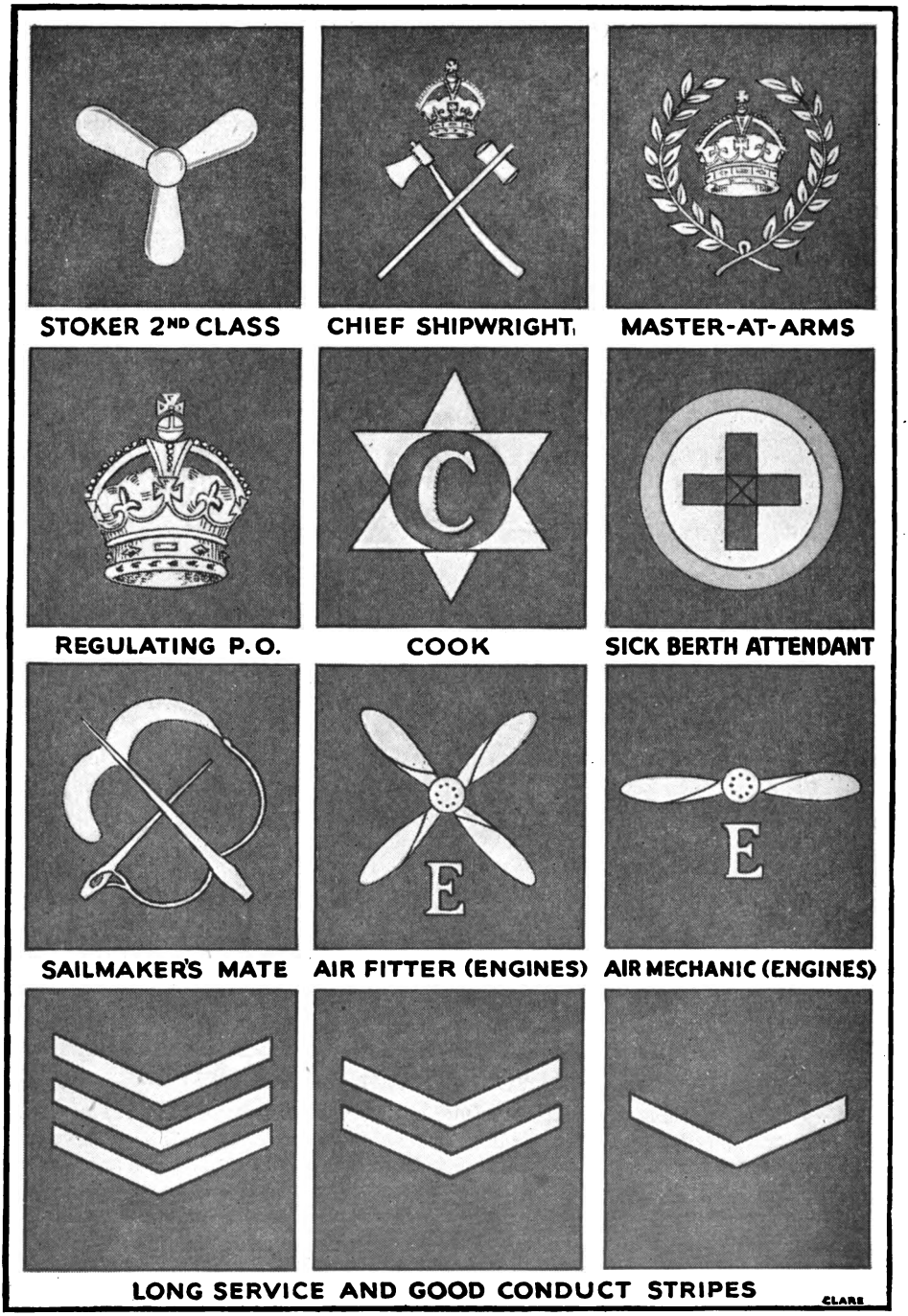

SOME OF THE NON-SUBSTANTIVE BADGES WORN BY

These badges are worn on the right arm, or in the case of C.P.O.s, on the lapels. When worn

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PETTY OFFICERS AND RATINGS OF THE ROYAL NAVY

on working rig, they are red but on white uniforms they are blue, and on "No. 1s," gold

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three years and eight months. He then spends one term in H.M.S. *Excellent;* then two terms in H.M.S. *Vindictive*, a sea-going training ship. He is then rated midshipman. After two years and four months in that rank he presents himself for an examination in seamanship. This fence being safely surmounted, he joins the Royal Naval College at Greenwich as an acting sub-lieutenant. Subsequently he passes through gunnery, torpedo and navigation courses at Portsmouth.

In each of those five examinations a class of proficiency is awarded, either one, two or three. According to the certificate obtained, his seniority as sub-lieutenant is determined. His substantive seniority is dated six to nine months from the date of his seniority as acting sub-lieutenant. Having become a lieutenant he can, if his previous record is satisfactory, apply to specialize in gunnery, torpedo or the Naval Air Arm. He remains a specialist officer during the whole of his time on the lieutenants' list. After several years at sea he may be given a staff appointment at either the gunnery or the torpedo school, or remain at sea as the first lieutenant of a large ship. Then having made his mark both in his examinations and his practical work, he is promoted to commander.

INSTRUCTING NAVAL CADETS

Naval cadets undergo an intensive course of training before becoming midshipmen. All branches of naval knowledge are covered. These boys are being instructed in the various classes of warship in the Royal Navy. The model is of the fleet at a peace time naval review at Spithead

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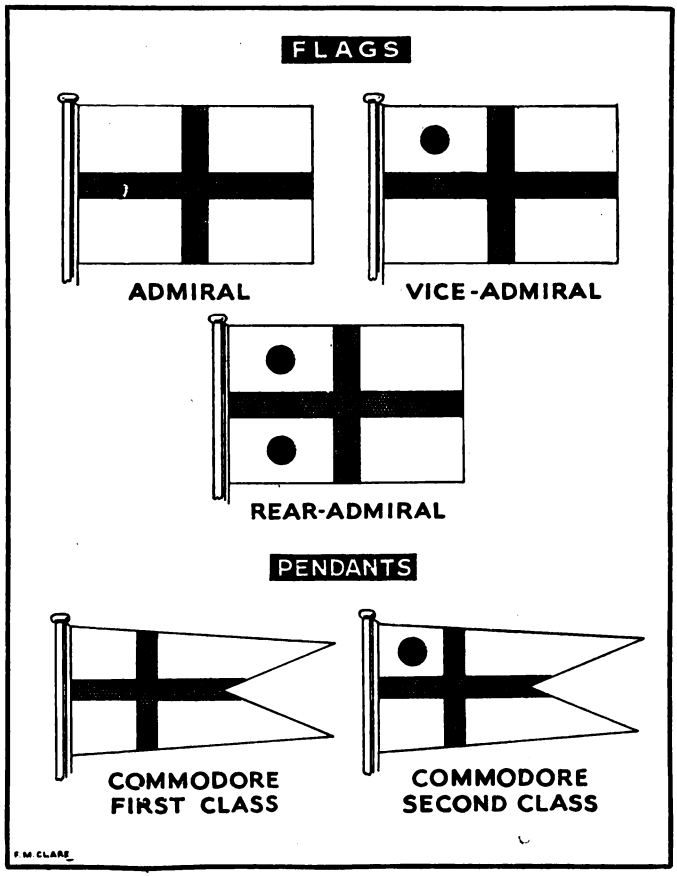
Here the gunnery and torpedo man drops specialist work; the air arm officer remains on in his branch of the Service. While on the commanders' list he must once again make his mark if he is to obtain early promotion to the rank of captain. After that has been successfully achieved he arrives on the list where, according to the old saying, "Officers are all fools alike!" In other words, further promotion is by seniority, not by selection, except in certain special instances of war service.

In due course he arrives on the rear-admirals' list; and, if marked as having special qualities, he rises through various commands until he becomes First Sea Lord of the Admiralty or commander-in-chief of one of the home ports. After this he may be promoted to Admiral of the Fleet.



FLAGS AND PENDANTS FLOWN BY NAVAL OFFICERS
Fig. 8. *Admirals and commodores hoist their flags in the flagships of their commands, and are known as "Flag Officers." The flags are "worn" and not "flown" by the ships concerned. The crosses and balls are coloured red on a white ground*

War conditions alter the details of the foregoing procedure. Special promotion is gained by those who distinguish themselves greatly in engagements with the enemy. The entry of officers is radically altered, and periods of instruction accelerated. There is also a later entry for officers from the public schools.

The chief points in a naval officer's career that should be noted and appreciated are, first, that every one from midshipman to admiral has daily to shoulder responsibility. This is a fundamental part of his training. Second, an officer has to show marked ability in each successive rank in order to gain promotion.

Now let us return to the fleet. If the admiral happens to be commander-in-chief on some foreign station, or if he commands one of the large fleets in home waters, he will have cruiser squadrons, destroyer flotillas and submarines as well as a number of auxiliary craft under his

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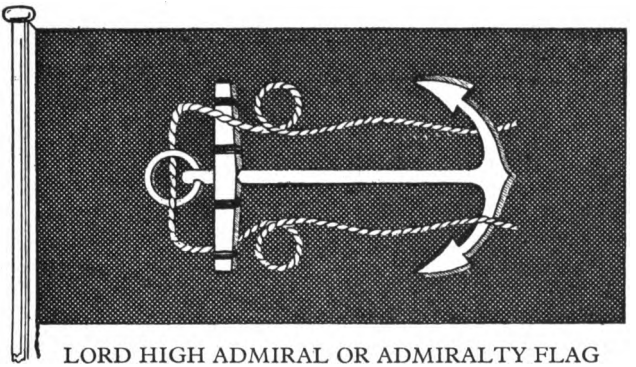

LORD HIGH ADMIRAL OR ADMIRALTY FLAG

Fig. 9. *The Admiralty flag is the symbol of the Board of Admiralty. It consists of a yellow anchor on a red ground*

orders. These will each be under the immediate charge of a rear-admiral, commodore or captain, who is responsible for them, and through whom the commander-in-chief transmits orders for their employment in the manner required.

The Admiral in command of a fleet is therefore a busy person and requires a considerable staff to help him to administer satisfactorily the whole of his flock. His position is somewhat analogous to that of a governor and commander-in-chief of a province, in that he has not only the fighting organization and command under his personal control, but is also head of civil life.

ADMIRAL'S "DEVIL"

A Commander-in-chief has as a personal assistant a chief of the staff who assists him in the preparation of war plans and the disposition of the ships. He is head of the intelligence section and generally "devils" for the Admiral in all that appertains to the fighting of the fleet. The officer next in importance is his secretary, who deals with all correspondence and the five hundred and one returns which have to be rendered to an ever-increasingly inquiring Admiralty.

To supervise and advise him on matters connected with the machinery of the fleet, needless to say a most important matter, he has on his staff an Engineer Captain who also scrutinizes all the engine-room registers and other documents, keeping at the same time a vigilant eye on the fuel consumption and future steaming requirements of the fleet.

As a personal A.D.C. he has a Flag Lieutenant who is in charge of the signalling and signal instruction of the fleet.

The captain of the flagship, called the Flag Captain, is also one of the members of the Admiral's staff. His duties lie rather in the direction of arranging the domestic routine of the ships, the daily, weekly and monthly routine, drills, boat work, washing clothes and all such household work, as well as, of course, the discipline of his own ship and her her navigation. This is a responsible and onerous position.

The navigating officer of the flagship is also the navigator of the fleet and, when at sea is, in matters of navigation, responsible to both the Admiral and his own Captain. The quaint custom of every ship of the fleet signalling the latitude and longitude according to her reckoning at 1 p.m. every day when in company with the fleet at sea, still survives. In fine weather, in these days, there is little use in so doing. But after days at sea in thick weather, out of sight of land and without astronomical observations, the custom still affords information confirmatory, or otherwise, of the position as estimated by the flagship's navigating officer.

It may be gathered from this review that the activities of an Admiral are analogous to those of the elephant which is supposed to be able to pick up a pin or a baulk of timber. He is, in fact, called on to give decisions on matters ranging

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from intricate war problems to the fate of a recalcitrant ordinary seaman. All this he does without undue strain, thanks to the large volume of preparatory work done by his competent staff.

On the distant stations the commander-in-chief usually has an official residence ashore at the principal port. This allows of more convenient administration and, when he is absent, a small staff can be left to continue the clerical work.

THE ADMIRAL'S FLAG

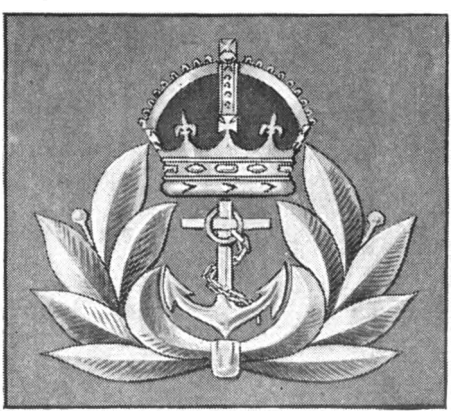
To complete the ability of the fleet to cope with any emergency every large ship is capable of becoming a flagship. In fact, the large ships are all built as flagships, the admiral's accommodation being occupied by the captain when a private ship. But in an hour or so everything can be made suitable to accommodate the admiral and his staff. It not infrequently happens that, in a sudden emergency, the flagship may be undergoing a small refit and the admiral has suddenly to shift his flag to another ship at short notice—another example of the adaptability of the Navy.

The flag flown by an admiral is a square white flag with a red St. George's cross. If there are two or more masts it is hoisted at the main, or principal, mast. A vice-admiral carries on a similar flag a red ball in the upper corner nearer to the mast, and would fly it at the foremost mast; the rear-admiral has two balls in the same corner and would fly it at the aftermost mast-head. These flags (*see* Fig. 8) are never hauled down except during the absence of the admiral. A commodore first class is in reality a captain who has been given brevet rank. He flies a "broad pendant," i.e., a white swallow-tailed pendant with a red St. George's cross. He wears the broad rear-admiral's stripe on his arm without the narrow stripe. A second-class commodore has only local rank and wears a captain's uniform and flies a ball on his pendant.

At the three home ports, Portsmouth, Plymouth and the Nore, the commander-in-chief never goes to sea in command. He flies his flag in one of the harbour ships. His duties are almost entirely administrative and ceremonial. All the local establishments come under his command, including the naval hospitals in the immediate vicinity.

The highest of all ranks in the Navy is that of Admiral of the Fleet, corresponding to Field Marshal in the Army. Except in wartime this rank rarely carries command with it. It is the honorary crown of a long and successful career. In wartime it may be bestowed on the commander-in-chief of our battle fleet, or on the First Sea Lord of the Admiralty. When on active service he flies a Union Flag at the main.

Another shore appointment for admirals is that of superintendents of our dockyards. These are held by rear-admirals, and their duties are well described by their designation. They superintend the activities in our dockyards and associated shore establishments. Usually the appointment comes at the termination of their long and arduous sea-service career.



OFFICERS' CAP BADGE

Fig. 10. *This badge is worn by all officers, including commissioned warrant officers, midshipmen and cadets of the Royal Navy*

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INSPECTING THE ROYAL MARINES

The Royal Marines are famous for their smartness and efficiency. General Catroux, of the Free French Forces in the Middle East, is here inspecting a bodyguard drawn up in his honour on the flagship of the Commander-in-Chief, British Mediterranean Fleet

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CHAPTER 4

The Corps of Royal Marines

Soldiers afloat. The Maritime Regiment of Foot. Gunnery training. Two systems of entry. Structure of the Corps. The "King's Squad." Prowess in the Field. Co-operation with R.A.F. In every major sea fight. Tried to the limit, never failed. Tattered sea-stained muster-roll

Since Carolean days their war-scarred drums
Have thundered down the waterways of time,
And still the pæan of their bugle comes
From every sea and latitude and clime.

WHO are the Marines? Simple souls in sea-stained red coats to whom one told tales no one else would swallow? Till recent years, and beyond the environs of Chatham, Portsmouth and Plymouth, that was a popular conception of them, and Captain Marryat's novels were partly responsible for it. That gallant sailor detested his soldier shipmates; probably he had been badly scored off by one of them. In any case he seems to have kept on his inkstand a bottle of vitriol into which to dip his magic pen when describing them. His pages sometimes suggest a sea bull affronted by the red coat of a Marine. Yet even he was impelled to pay them a fine tribute in *The King's Own*.

Along with that of the rest of the "silent" Navy the work of the Marines throughout the centuries has been done for the most part out of sight and knowledge of the general public. They share to the full, moreover, their naval comrades' dislike of advertisement. Equally, too, they share the kicks incidental to their joint calling. But in bygone years the Admiralty's shower of ha'pence, which sometimes followed the kicks, rarely came their way. To the majority of landfolk, therefore, the Marines have been little more than dim figures glimpsed here and there through the smoke of historic battles. And though the Corps has largely come into its own again, there are benighted places where, in common with a belief in pixies, the tell-it-to-the-Marines legend still lingers.

To begin with, then, what precisely is a Marine? The Army Act tells us very definitely and with an admirable economy of words. He is "a Soldier of the Regular Forces." Not "soldier an' sailor too," as Kipling picturesquely but inaccurately describes him. Still less does the common definition "half-soldier, half-sailor" fit him. He is "half" nothing at all. He is first and last and all the time a SOLDIER, and probably the most finished specimen of the infantry soldier in the whole world of arms. But he is also many other things in addition, with which the Army Act is not directly concerned.

ROYAL MARINES' ORIGIN

The Marines were raised originally, and are still trained, for service in the Fleet. The Maritime Regiment of Foot, as it was christened on October 28, 1664, was largely raised from the Train Bands of the City of London. It is the Admiralty, not the War Office, by whom they are administered and paid.

A few years ago, by command of their Colonel-in-Chief, the King, the Marines

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mounted guard over the royal palaces in London during the absence of the Guards for their annual field training. Other regiments have also enjoyed this honour. But at that time it was an innovation, and all London flocked to see it. Some doubtless came to scoff. They stayed to praise with no uncertain voice. For the discovery that these strange soldiers from the sea could carry out the intricate ceremonial with a precision unsurpassed by the Guards themselves

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GREAT ENCOURAGEMENT.

AMERICAN WAR.

What a Brilliant Prospect does this Event hold out to every Lad of Spirit, who is inclined to try his Fortune in that highly renowned Corps,

The Royal Marines,

When every Thing that swims the Seas must be a

PRIZE!

Thousands are at this moment endeavouring to get on Board Privateers, where they serve without Pay or Reward of any kind whatsoever, so certain does their Chance appear of enriching themselves by PRIZE MONEY! What an enviable Station then must the ROYAL MARINE hold,—who with far superior Advantages to thefe, has the additional benefit of liberal Pay, and plenty of the best provisions, with a good and well appointed Ship under him, the pride and Glory of Old England, furely every Man of Spirit muft blufh to remain at Home in Inactivity and Indolence, when his Country and the beft of Kings needs his Assistance.

Where then can he have fuch a fair opportunity of Reaping Glory and Riches, as in the Royal Marines, a Corps daily acquiring new Honours, and there, when once embarked in the BRITISH FLEET, he finds himself in the midft of Honour and Glory, furrounded by a fet of fine Fellows, Strangers to Fear, and who ftrike Terror through the Hearts of their Enemies wherever they go!

He has likewise the infpiring Idea to know, that while he fcours the Ocean to protect the Liberty of OLD ENGLAND, that the Hearts and good Wifhes of the whole BRITISH NATION, attend him; pray for his Succefs, and participate in his Glory!! Lofe no Time then, my Fine Fellows, in embracing the glorious Opportunity that awaits you; YOU WILL RECEIVE

Sixteen Guineas Bounty,

And on your Arrival at *Head Quarters,* **be comfortably and genteely CLOTHED.—And Spirited Young BOYS of a promiling Appearance, who are Five Feet high, WILL RECEIVE** TWELVE POUNDS ONE SHILLING AND SIXPENCE BOUNTY **and equal Advantages of** *PROVISIONS* **and** *CLOATHING* **with the Men. And thefe who wish only to enlist for a limited Service, fhall receive a Bounty of** ELEVEN GUINEAS, **and Boys** EIGHT **In Fact, the Advantages which the** *ROYAL MARINE* **poffeffes, are too numerous to mention here, but among the many, it may not be amifs to state,—***That if he has a WIFE, or aged PARENT, he can make them an Allotment of half his PAY, which will be regularly paid without any Trouble to them, or to whomsoever he may direct: that being well Clothed and fed on Board Ship, the Remainder of his PAY and PRIZE MONEY will be clear in Reserve for the Relief of his Family or his own private Purposes. The Single Young Man on his return to Port, finds himfelf enabled to cut a Dafh on Shore with his GIRL and his GLASS, that might be envied by a Nobleman.—Take Courage then, seize the Fortune that awaits you, repair to the ROYAL MARINE RENDEZVOUS, where in a FLOWING BOWL of PUNCH, in Three Times Three, you shall drink*

Long live the King, and Success to his Royal Marines

The Daily Allowance of a Marine when embarked, is—One Pound of BBEF or PORK.—One Pound of BREAD.—Flour, Raisins, Butter, Cheese Oatmeal, Molasses, Tea, Sugar, &c. &c. And a Pint of the beft WINE, or Half a Pint of the best RUM or BRANDY, together with a Pint of LEMONADE. They have likewise in warm Countries, a plentiful Allowance of the choicest FRUIT. And what can be more handsome than the Royal Marine's Proportion of PRIZE MONEY, when a Sergeant shares equal with the First Class of Petty Officers such as Midshipmen, Assistant Surgeons, &c. which is Five Shares each, a Corporal with the Second Class, which is Three Shares each; and the Private, with the Able Seamen One Share and a Half each.

☞ *For further Particulars, and a more full Account of the many advantages of this invaluable Corps, apply to Sergeant Fulcher, at the Eight Bells, where the Bringer of a Recruit will recaive* THREE GUINEAS.

S. AND I. RIDGE, PRINTERS, MARKET-PLACE, NEWARK.

A ROYAL MARINES RECRUITING POSTER OF BYGONE DAYS

An appeal to join the Royal Marines in the war between the U.S.A. and Britain in 1812-14

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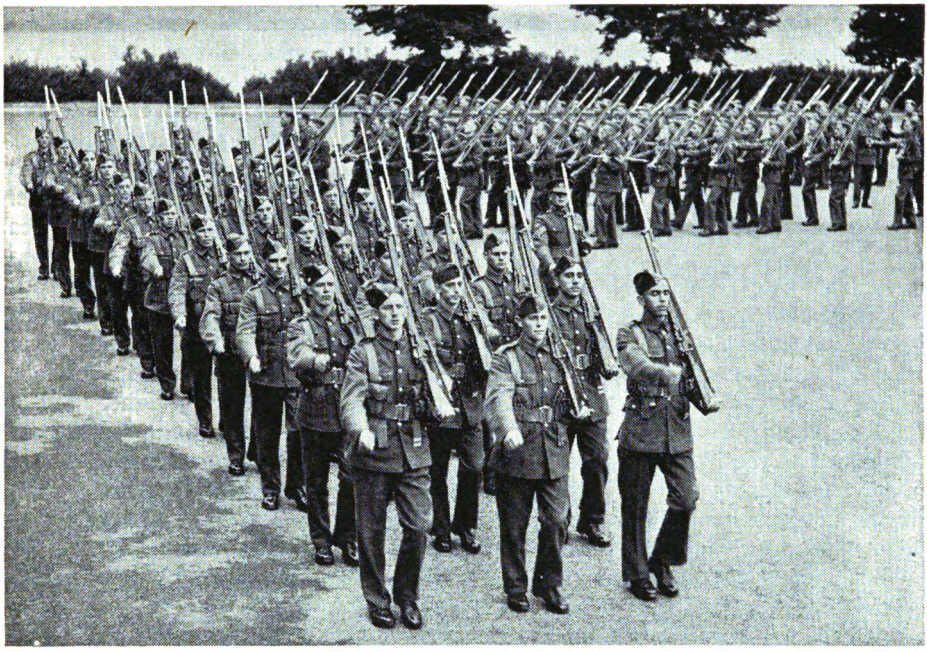

ROYAL MARINES ON THE BARRACK SQUARE

Close-order drill is the basis of good discipline and all recruits to the Royal Marines are put through a most strenuous course. They are noted for the magnificent precision of their arms drill

created a sensation, and London took to her heart again the regiment to which she had given birth some two and a half centuries earlier.

Then came the memorable send-off to the battalion as, in accordance with its ancient privilege, it marched through the City with bayonets fixed, drums beating and colours flying, on its return journey to the sea. One wondered how many among the cheering multitudes who lined the streets realized that those superbly drilled infantrymen were equally efficient gunners in the gun turrets of the ships of the fleet. For the Marines man their quota—a considerable one—of the fleet's armament, competing on equal terms with, and often beating, the expert seamen gunners of the Navy. Naval gunnery is an outstanding feature of their training, in the course of which they have to handle every type of weapon from the machine and A.A. guns to the monster 16-in. in the turret. Some of the heaviest ordnance in our coastal defences is also manned by the Corps.

There are at the present time two systems of entry into the Royal Marines: voluntary enlistment for a period of twelve years (with the option of re-engaging for a further nine), and enlistment "for the duration." Almost all the latter are trained for land warfare only, not being required to serve afloat.

To describe the full course of the Royal Marines' elaborate and very drastic training is impossible within the compass of a chapter. Beyond its main trunk of infantry and gunnery instruction its branches range from tailoring or the repair of searchlights to helping the Navy run a man-of-war.

The Corps' standard of achievement is high. In all these activities something

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far more than a smattering of knowledge is demanded. The training produces in the end a man of infinite resource, whose handiness age never seems to wither nor custom stale. For pensioned veterans of the Sea Regiment in notable numbers fill positions of trust and responsibility all over the Empire.

"JACK OF ALL TRADES"

The Marine is a jack-of-all-trades to whom the proverbial corollary does not apply: for, if not of all, he is at least master of many. He is no Admirable Crichton; he, of course, has his faults in common with the rest of humanity. But whatever they may be, he is most assuredly not permitted to number among them inefficiency or slovenliness.

Versatility is no new development in his character; it would seem to have been a long-established tradition of the Corps. One random instance I recall:

Some sixty years ago her subaltern of Marines navigated the Mediterranean flagship—H.M.S. *Caledonia*, I think—from the Levant to Malta. It appeared that to his many military certificates he had added that of Master Mariner. A curious emergency, too complicated to detail here, had arisen, and the Marine stepped into the breach. The job, of course, was done unofficially, though one imagines none the less efficiently for that. For, after threading her intricate course through the islands of the Greek Archipelago, the ship arrived at her destination without mishap.

A year or two later this master mariner was filling the role of adjutant, and a notably smart one, in a Corps that specializes in smartness. I think of him as the kindly martinet who licked my contemporaries and myself into shape on Chatham parade ground in the early 'eighties. Incidentally—another instance of his versatility—he was an accomplished musician, having studied under Dr. Monk, the famous organist and musical editor of *Hymns Ancient and Modern*.

The foundation stone of this many-storeyed structure of the Corps is the drastic parade drill the recruit receives on joining, the result of which evokes the wonder of civilians and soldiers alike. It has always been a speciality of the Sea Regiment. Formerly the recruit was passed through a succession of squads till, at the end of some eight months, he emerged from the highest, the "First Squad," like a butterfly from its chrysalis stage. In these days of a higher level of education and intelligence the same standard of perfection is achieved in a somewhat shorter period.

The passing out of the First Squad at the Deal depot has always been a "military occasion." So impressed was His late Majesty King George V after witnessing the ceremonial that he commanded that each successive First Squad should be known in future as the "King's Squad." The immaculate appearance and flawless precision of movement of the King's Squad of the Royal Marines have roused the enthusiasm of many an audience at Olympia and elsewhere. So gruelling is the process of acquiring this world-famous polish that the product is rendered practically rust-proof.

THE KAISER'S QUERY

When at Malta in pre-1914 days the late Kaiser chanced to see the Marines of the fleet landed on parade, he asked which battalion of the Guards he was watching. Yet the unit was composed of detachments most of whom had never drilled together before. But every man of them had at one time or another been stamped with the indelible hall-mark of the First (now the King's) Squad.

As far as my own experience goes, Scriptural quotation is not a habit of the drill sergeant of the Royal Marines. None the less, in the first hour of the

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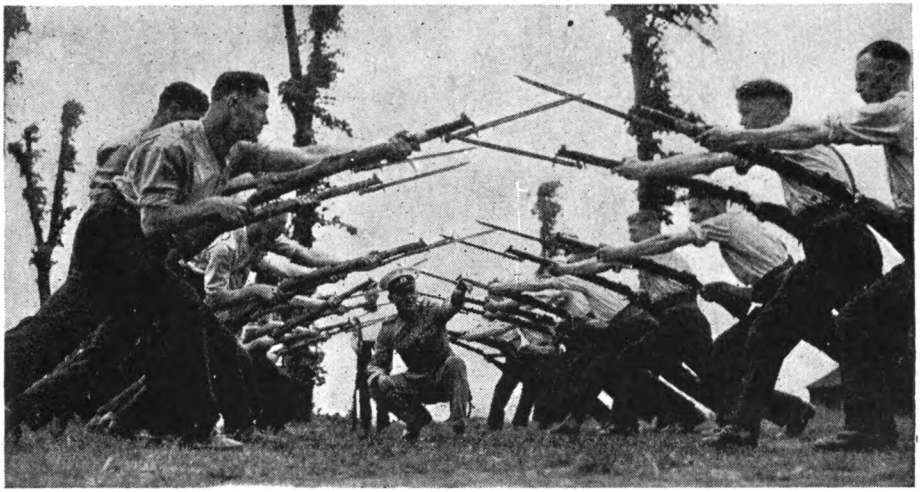
recruit's training the precept "whatsoever thy hand findeth to do, do it with thy might" is graven on his soul.

So varied and widespread have been the activities of the Royal Marines in the vast theatre of the Second World War that no more than a brief summary of them can be attempted. One fact stands out prominently from the record. The Corps has constantly played its traditional role of being first in the danger zone and last to leave it—if at all.



ROYAL MARINES AT BAYONET PRACTICE

Marines are used as picked shock troops and it is essential that they should be really efficient in the use of the bayonet. Their high standard of training has often stood them in good stead

A few days after the German invasion of Norway, early in April, 1940, and about two days in advance of our own Army, a party of Royal Marines and seamen under Captain W. F. Edds, R.M., landed at Namsos. At about the same time a combined force of 420 Marines and 300 naval ratings, together with a searchlight unit and an A.A. battery, both R.M., were landed at Andalsnes and Aalsund under the command of Lieut.-Colonel H. W. Simpson, R.M. It was the first British force to operate in that part of Norway. It successfully covered the disembarkation of a large number of our own troops, held the environs of Andalsnes until April 30, and in due course ensured the safe withdrawal of the troops. It also co-operated with the R.A.F. in improvising air bases. For these exceedingly difficult tasks the Royal Marines gained several decorations, Colonel Simpson receiving the D.S.O.

On the last day of the British evacuation a little party of five Marines added yet another leaf to their regiment's laurels. To cover the retirement of an army brigade from Verma, two platoons of the Royal Marines and one from the Green Howards were dispatched under the command of Lieutenant E. B. Stroud, R.M., to occupy a position a few miles south of that town. His orders were to hold the position till 9.30 p.m., when the final withdrawal would take place.

The force arrived at 4 p.m. It was not expected that the enemy would be encountered, as the road in front of the position was said to have been destroyed. But at 5.55 p.m. it was suddenly reported by runner that the Germans were advancing up the road in considerable

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strength. Unauthorized orders, probably by Fifth Column agents, then appeared to have been given. The majority of the force withdrew, taking the transport with them, and leaving Lieutenant Stroud, a corporal and three men alone to hold the road to Verma. Their total armament was two Lewis guns and two rifles!

For three and a half hours these gallant Marines succeeded in holding up a strong enemy force and in deceiving it as to their numbers. They were under constant mortar and machine gun fire. Yet not until the time stated in his orders—9.30 p.m.—did Stroud withdraw. By this action the successful evacuation of the British troops at Andalsnes was made possible with astonishingly small casualties. It is interesting to note, as yet another instance of the heredity to which I shall refer later, that Lieutenant Stroud is the son of a former General in the Corps.

One despairs of being able even to summarize adequately the exploits of the Marines in Norway alone. In the evacuation of Namsos on May 3, a Royal Marine battery of seven howitzers under the command of Captain G. W. Wilson, R.M., succeeded in the face of extreme difficulties in bringing back all its guns for re-embarkation. A few days later a fortress unit (R.M.) under Lieut.-Colonel H. R. Lambert, D.S.C., effected the landing of stores at Harstad, north of Narvik, whence, despite a heavy air attack, ammunition for the French forces was carried into the Narvik Fiord by a boat unit under Captain H. J. Hasler, R.M.

I pick out from the operations on the Norwegian coast those of Major G. V.

ROYAL MARINES LANDING IN

These soldiers of the Royal Navy are specially trained in the making of landings upon enemy-occupied coasts. Much courage and skill are needed if tactical points are to be won

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Walton, R.M. and his detachment from H.M.S. *Resolution*. It is briefly the tale of a hunt over mountains deep in snow for a party of German airmen who had made a forced landing and were causing trouble. The plane was found abandoned and bearing traces of having carried British prisoners. After a widespread search and many "moving adventures by field and flood," the enemy was eventually tracked to his lair amid the snows. The story ends with a simultaneous frontal and rear attack on a village, the driving out of its garrison, the capture of nine Germans (one being killed), and the rescue of the British prisoners—one officer and five seamen.

At one and a half hours' notice only, a party of Marines under Major B. G. B. Mitchell, who gained the D.S.C. for his good work, left Chatham to hold the Hook of Holland, thereby enabling an Army battalion to land and subsequently to evacuate members of the Dutch Royal Family and Government.

At similar notice another R.M. party left to help cover naval demolitions at Boulogne. For this, Major C. F. L. Holford was awarded the D.S.O. Again at the same brief notice a third contingent of Marines, under Captain G. W. A. Courtice, was dispatched to assist in holding Calais. Many were killed, Sergeant Mitchell gaining a D.C.M. for gallantry.

An even more striking instance of the Sea Regiment's readiness for sudden emergency was afforded early in May, 1941, when, within six days of receiving its entirely unexpected orders at its camp in Southern England, a force of Royal

STRENGTH ON AN ENEMY COAST

from the enemy swiftly, while he is still taken unawares. These Marines are advancing in strength after a successful landing on a beach. Speed is of vital importance in such a scheme

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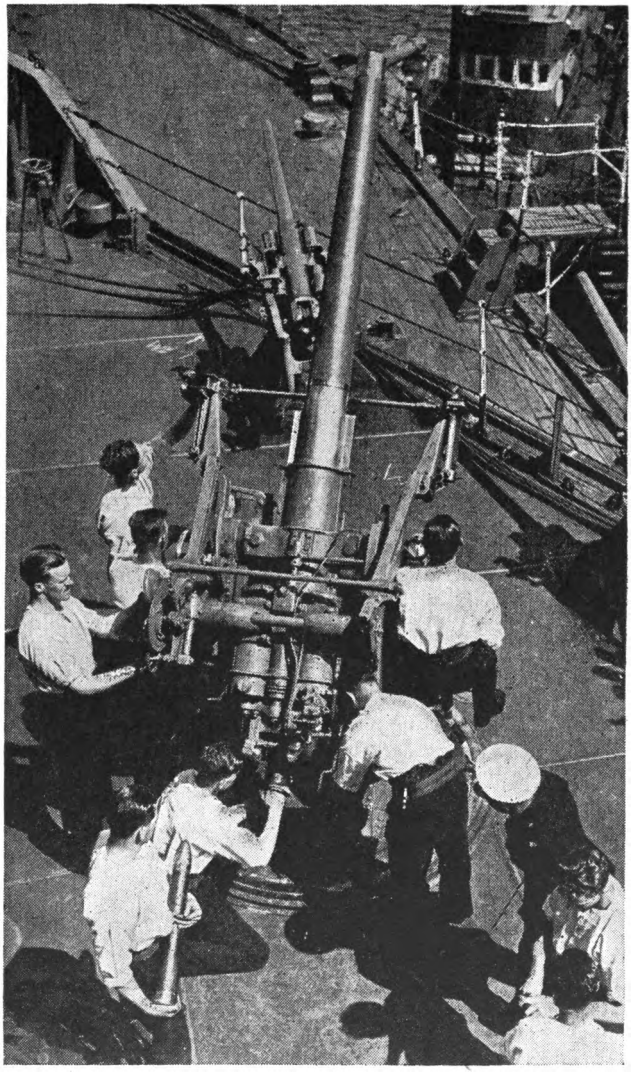

ROYAL MARINES AT GUN PRACTICE

Quite apart from their duties as soldiers, the Royal Marines man a big proportion of the guns of the Royal Navy. These men are practising the technique of A.A. gunnery in a training ship

Marines was in occupation of seventy miles of the coast of Iceland. The C.O. was Colonel R. G. Sturges, R.M. The Faroe Islands were similarly held by Lieut.-Colonel T. B. W. Sandall, R.M., till his own and the Iceland force were both eventually relieved by the Army.

Meanwhile, that other part of the Corps serving afloat has been no less active. It has shared in every major sea fight from the River Plate to Cape Matapan, manning its allotted guns of the fleet, contributing its quota to the casualty lists, and adding to its tale of honours. In the action with the *Admiral Graf Spee* alone, it collected eight awards and five mentions in dispatches.

But their fighting is by no means confined to battleships and cruisers. As in the war of 1914-18, in armed merchantmen as well as in many of the small ships of the Navy, in little detachments or as single guns' crews, the Royal Marines are maintaining the high traditions of their Regiment on all the Seven Seas. A list of their deeds in the Eastern Mediterranean, with its sprinkling of Greek names, is faintly reminiscent of Homer's resounding catalogue of the ships.

The Royal Marines are a notably hereditary Corps. "Once a Marine always a Marine" would seem to apply to families as well as to individuals. For a high percentage of all ranks, especially of the "Drums," are the sons of Marines, and many can trace their pedigree through several generations of the Corps. One officer indeed is reputed to have held the swords and commissions of his forebears

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in the Sea Regiment in unbroken succession from the reign of William and Mary. Alas, the long chain was snapped when his only son died in infancy and he himself fell at Zeebrugge.

Zeebrugge! If the storming of the Mole at Zeebrugge was the Corps' outstanding feat of arms in the war of 1914-18, its magnificent rearguard action in Crete is certainly, so far, its crowning achievement in this Second World War. And the latter has a curious and interesting parallel in history worth recalling.

A DESPERATE VENTURE

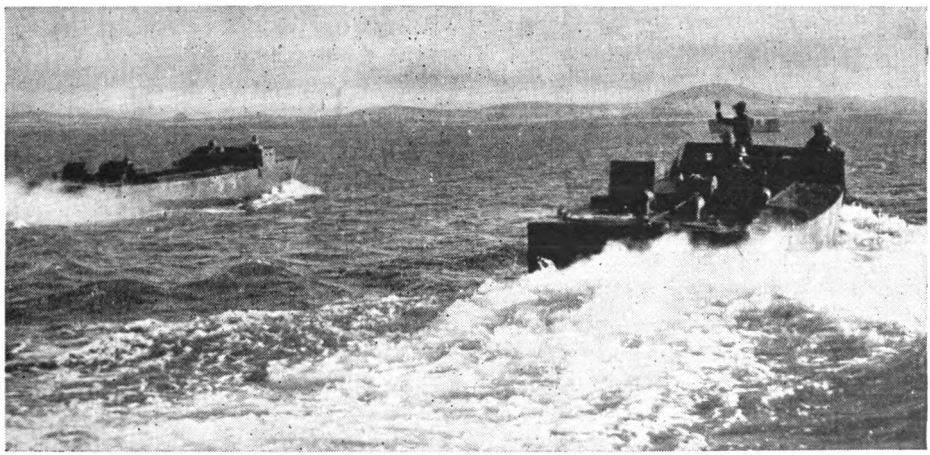
About the middle of the eighteenth century a little ship of George II's Navy, H.M.S. *Wager*, was wrecked off a desolate island in the Atlantic. A handful of survivors, including four Marines, escaped ashore in her one remaining boat, only to find that they had exchanged the frying-pan for the fire. For the provisions they had been able to bring with them were of the scantiest, and the only food yielded by the island was shell-fish.

It was decided to patch up their leaky boat and try to make the nearest land, some thousand miles away. It was a desperate venture, but the alternative was famine. Then it was realized that the boat was too small to carry the whole party on so long and stormy a voyage; some of them must be left behind. To give their shipmates a better chance of saving their lives, the Marines to a man volunteered to sacrifice their own and face a lingering death by starvation. Their names were, Corporal Crosslett and Privates Smith, Hobbs and Hertford.

It was a fine gesture, the dramatic climax of which was reached when, to speed the parting boat, they lined the beach and cried "God save the King!" Imagination pictures the four lone figures in their faded scarlet uniforms slowly vanishing like ghosts into the sea mist. Nothing more is known of them. But they had added another poignant line to the great sea epic of their Regiment.

ISLE OF CRETE

Two hundred years later the Regiment wrote, on similar though grander lines, another chapter of that epic. Again the scene was an island—the tragic isle of Crete. One sees it vividly, the ancient ramparts of the town, the windmill-dotted



MARINES APPROACHING AN ENEMY COAST

When nearing an enemy coast upon which it is intended to land, Royal Marines and any other troops are transferred into special self-propelled barges for the last part of the journey

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plain, the Sleeping Turk mountain, the dominating purple peak of Mount Ida.

Among the British and Imperial troops who held Crete in 1941 were 2,000 Royal Marines. All were specialists—coast defence and A.A. gunners, searchlight personnel and signallers—and it was not until their guns and searchlights had been put out of action that they were hastily formed into infantry units. This could not have been done had not their basic training been that of infantry, and but for the fact that whatever his job, wherever he goes, the Royal Marine carries his rifle and bayonet with him.

HERCULEAN TASK

All the world knows the story of how our fighting men were set the herculean task of repelling an overwhelmingly powerful enemy. But what has chiefly stirred its imagination is the last stand of that superb sea infantry who, at the cost of more than half their numbers, enabled the bulk of the withdrawing garrison to reach safety.

The terrain over which the Marines and Australians fought their memorable rearguard action was Alpine in the extreme. There was only one road, a length of it unfinished, which dropped 2,000 feet from the mountain tops to a stony plain in a series of hair-pin bends. It was with the utmost difficulty that supplies reached the force. During the last two and a half days it was on reduced food and water rations, and was under constant fire and attacks from the air.

On the final night of the evacuation it was found impossible to re-embark these men. Like their predecessors, the Marines of H.M.S. *Wager*, they remained behind on the island from which their self-sacrifice had enabled their comrades-in-arms to escape. Another parallel to the episode is finely suggested in the following lines by Mr. F. Seymour Cocks, M.P., with whose permission I quote them. They are based on General Wavell's message: "This is the last night the Navy can come":

"Off British ships we came to hold the Nazi Minotaur,
We made the sacrifice of youth that Athens made of yore;
We held the beast at bay and saved the vanguard of the host,
We faced, and fought, and slew the foe from Ida to the coast;
And now in Cretan caves we lie and scan the seas in vain,
Theseus came oft and saved the rest, but cannot come again."

Among the awards to the Royal Marines for gallantry, skill and enterprise in face of the enemy in Crete are a C.B. to Major-General E. C. Weston, commanding, a D.S.O. to Major Ralph Garrett and an M.C. to Captain A. L. Laxton. The latter, who was badly wounded, gallantly led two R.M. platoons, improvised from signallers and searchlight crews, and drove a large force of parachute troops out of a gun position they had captured. Major Garrett's 250-mile voyage in an unsteerable, dangerously crowded boat, jury-rigged with blankets, and with relays of men going overboard to push her on her course, should rank among the most notable boat voyages of history.

TRIED TO THE LIMIT

In speaking officially of the Corps, on July 16, 1941, in London, the First Lord of the Admiralty said: "They have been tried to the limit in every quarter of the globe and they have never failed. In the last hours of the fierce battle of Crete it was the Marines who fought the rearguard action, never flinching and never yielding. They suffered grievous losses, and proudly sustained the immortal traditions of their Corps."

There is a touch of King Solomon in George IV's reply to a petition that he

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INTERIOR VIEW OF A LANDING BARGE

The landing party keep well down under cover. They are armed with automatics. The barges can also carry light mechanical vehicles, which are hauled aboard by the winch on the stern

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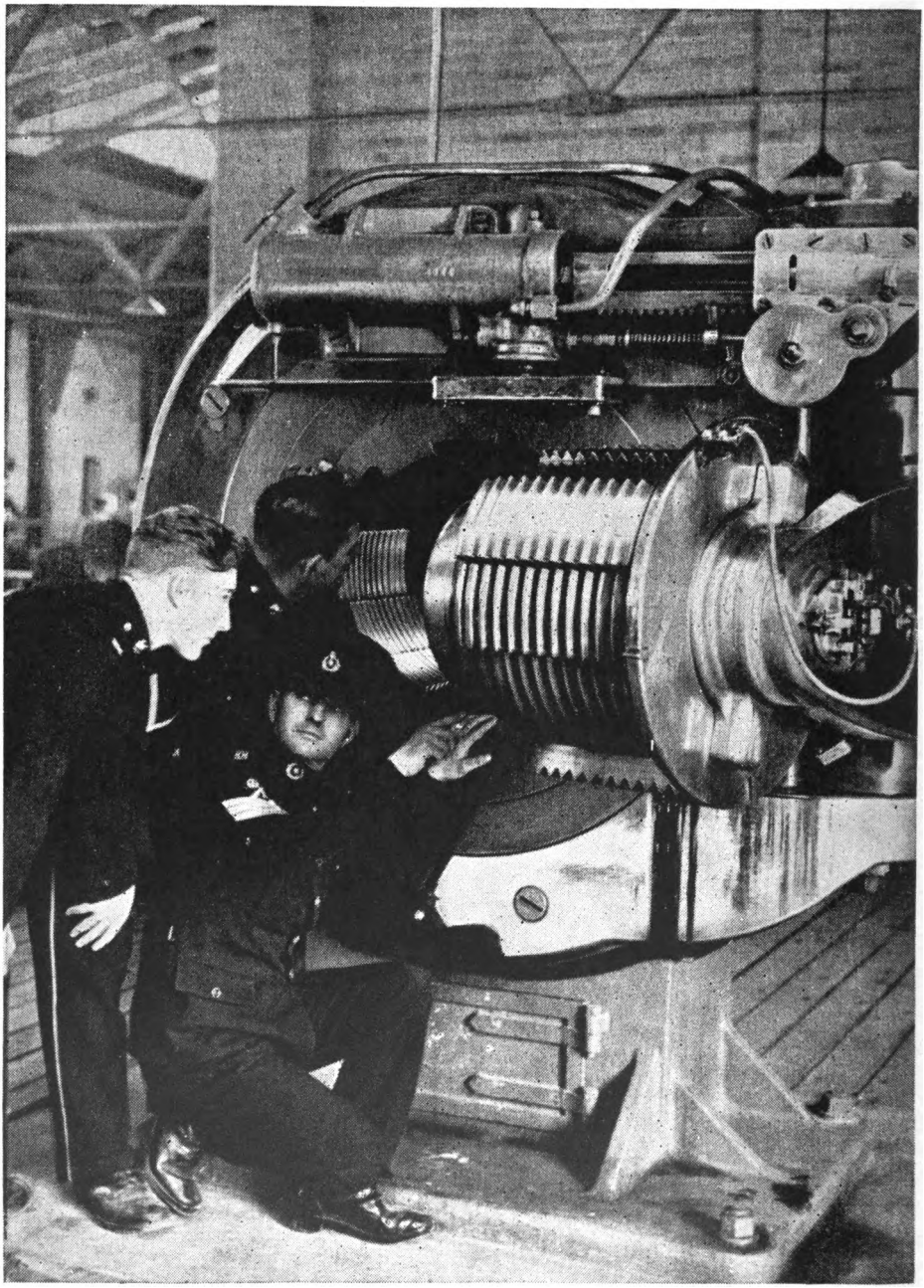

ROYAL MARINES AT GUNNERY INSTRUCTION

Royal Marines man nearly every type of gun used by the Royal Navy and also many coast-defence guns. Here recruits are being taught the details of the breech of a 15-in. gun. The grooves in the breech block must resist great pressure and the mechanism is power operated

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would select the battle honours for the Corps' new colours. Since not even the mainsail of a frigate, he declared, would be large enough to contain the complete list, the Marines should have "for their token the Great Globe itself." The globe, therefore, has been the central feature of their regimental badge ever since; a globe encircled by the laurel wreath awarded them for the capture of Belle Isle in 1761. A lion and a crown surmount it: an anchor recalls the Regiment's connection with the sea. But so microscopic is the last—from lack of space, presumably—that the lady may well be pardoned who asked why Marines wore fish-hooks on their buttons!

VALUED HONOUR

One name, however, and one only of the brilliant list, figures on colours and accoutrements alike—that of Gibraltar. It commemorates the capture, and still more famous siege, of the Rock in the distant days of Queen Anne when, under the Prince of Hesse, Sir George Rooke and Sir Cloudesley Shovel, the Marines won immortality. It should be added that the greatly valued honour of wearing the name is rightly shared by our gallant comrades the Dutch Marines.

Per mare terramque vincimus was once the proud motto of the Marines. But in softer times sentiment jibbed at the triumphant verb, which was accordingly deleted, the present *Per mare per terram* being held to suffice. Today another word might fittingly be substituted, and the motto re-written, *Per mare per terram aeremque*. For, as in the last war, the Corps is again fighting with great distinction, in all three elements.

The "tattered sea-stained muster-roll" of the Royal Marines bears many a name famous in English history. Marlborough and Wolfe each held for a time a commission in the Marines. Some of our most distinguished admirals in the past have been proud to write "Colonel of Marines" after their names, and even Nelson nursed a grievance against the Admiralty for their delay in granting him the honour. The custom has been happily revived today, and Admiral of the Fleet Sir Roger Keyes is an hon. Colonel Commandant of the Corps.

That muster-roll too—and this is surely unique among regimental records—bears the names of five Kings of England, all of whom as naval officers have served with the Marines at sea. The first of them, James II, when Duke of York, gave his name to the regiment and fought with it very gallantly at sea against the Dutch. William IV was General of Marines; George V, Edward VIII and His present Majesty each in turn has honoured the Corps by becoming its Colonel-in-Chief.

"*L'infanterie d'Angleterre*" a famous French soldier once declared, "*est la meilleure du monde. Heureusement, il n'y en a pas beaucoup.*" Even so one doubts whether he had ever met her "*Infanterie de la Marine.*" Well, Napoleon had. After inspecting the Marines of H.M.S. *Bellerophon*, when a prisoner on board, he exclaimed to his staff: "How much might I have accomplished with a hundred thousand soldiers such as these!"

HISTORIC EULOGY

It was a tribute of which the Corps may well be proud. But there is another that it prizes more highly still, the historic eulogy by Admiral Lord St. Vincent. "I never knew an appeal to them for courage, honour or loyalty," he said, "that they did not more than realize my highest expectations. If ever the hour of real danger should come to England, they will be found the country's sheet anchor."

If the gallant spirit of John Jervis still watches them today, I think he must on quite a number of occasions have made the signal, "Well done, Marines!"

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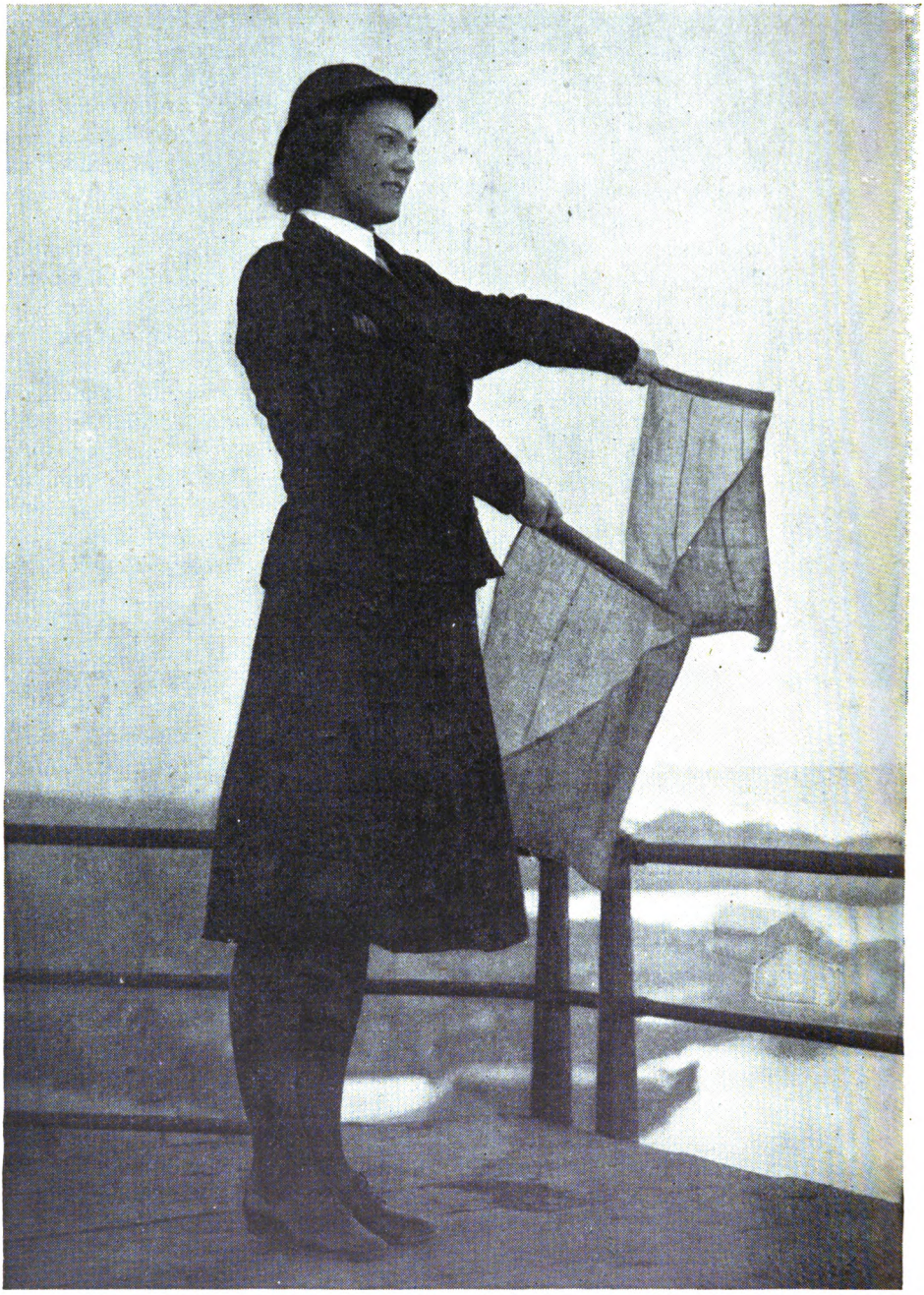

A WREN SEMAPHORE SIGNALLER

Visual signalling is still much used by the Royal Navy and members of the W.R.N.S. are often very skilled in it. Over short distances it is both an effective and economical method

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CHAPTER 5

The Women's Royal Naval Service

Origin of the W.R.N.S. Introduction of women into the Navy an innovation. Drafting and training. Domestic workers. Clerical. Cipher staff. Ship commissioned by Wrens. Dispatch riders. Wireless telegraphists. Instruction in navigation. Training and duties of W.R.N.S. officers. Fine spirit of the Wrens. Complimented by the Admiralty

IN 1939, when war seemed inevitable, the Admiralty decided that a women's service auxiliary to the Navy was essential, and appointed a director, and a deputy director (Miss E. M. Goodenough), to work out the details and prepare the way. Although the War Office and the Air Ministry had been first in the field with a women's service organization, the Admiralty was the first department to appoint a woman director with an office in the Admiralty. Before the Second World War broke out, however, this good example had been followed by the other two departments.

ORIGIN OF W.R.N.S.

Perhaps it is not generally understood that the Women's Royal Naval Service, which was formed in 1939, was an entirely new organization. At the preliminary discussions, the name of the new Service was one of the considerations. The decision to call the new Service by the same name as the organization of 1917-19 (the only one of the war departments to make that decision) was undoubtedly a compliment to the good name of the original Women's Royal Naval Service. And it enabled the new Service to start with a good tradition—a tradition which was further greatly emphasized by the appointment as director of the new Service of a woman who had served as a unit officer in the Women's Royal Naval Service in the war of 1914-18.

So the Wrens came into being once more, and several of the senior posts were filled by women who had proud and happy memories of their service with the Royal Navy in their youth.

Before the war thousands of women had registered their wish to serve the Navy, but there was no general mobilization on the outbreak of war. The Wrens were called up gradually, each one for a specific job, and the small numbers made individual selection possible. The gradual, steady and continuous growth of the Service has meant that the foundations could be firmly built. As the keel must be "well and truly laid," so it is all-important for an organization to start on the right lines and with the true spirit. The W.R.N.S., which has increased steadily to its present total of about 25,000, has always been in the fortunate position of having more applicants than vacancies. The Service is, moreover, still expanding rapidly to meet the ever-growing needs of the Royal Navy.

The title of this book, *Britain's Glorious Navy*, is demonstrated here in new guise. Perhaps the oldest and most conservative institution in the world, and the most removed from feminine entanglements (at work), yet how splendidly the Navy has withstood the shock of the introduction of women! Nothing could

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have been more generous than the way in which the Navy has adopted the W.R.N.S. and has made it part of itself. It is not too much to say that this attitude of the Navy has been the greatest factor in the success of the Sister Service.

True, in the early days, there were naval officers who declared that they would "fight against having Wrens, to the last ditch," but they were few in number, and they capitulated generously. As one commanding officer said: "I did not want to have Wrens, but as I had to have them I made the best of them; and I must say we have been very lucky in our Wrens!"

CAREFUL TRAINING

That last remark is one that is very often heard. Every commanding officer thinks his Wrens "exceptional." In cold fact the standard is very level. Every Wren is drafted as an individual and with the endeavour to make as much use as possible of her particular qualifications and civil experience. Sometimes it is difficult, as with the applicant whose civil occupation was a vet., and whose hobby was ballet dancing. She became a successful telephonist after training.

Over a thousand Wrens pass monthly through the Central Training and Drafting Depot in London, and a small depot has been established in each of the five home commands. Wrens who are already trained in their technical job receive a fortnight's disciplinary training and some insight into naval procedure.

Training is given to entries in a number of specialized categories, including pay clerks, teleprinters, coders, cooks, supply assistants, cinema operators and wireless mechanics. It is not surprising that the largest category of work in which women have replaced men in the Navy is the domestic. And without "throwing one's weight about," one may venture to believe that many a hard-worked naval officer or naval rating ashore has blessed the day when the care of his creature comforts was handed over to the Wrens.

Of all the women serving, these domestic workers, "the hewers of wood and drawers of water," deserve special praise. Their work is hard and their hours long. Their task, though immeasurably important, is not romantic, and their pay is considerably less than in civil life. But their spirit is magnificent. They work with a pride and an enthusiasm which has to be seen to be believed; and which, to be understood, means a realization of the capacity for service concealed in those who often are least articulate.

The clerical is the next largest category —secretaries, shorthand-typists, typists, ledger clerks, writers engaged on Service certificates; leave tickets and ration cards; writers in a ship's office, a drafting office, or a regulating office. There is hardly an office in any shore establishment which has not its quota of Wrens and a steadily diminishing proportion of naval writers.

Through the different branches of communications the Wrens take an active part in naval operations. Wren ratings, specially selected for their high qualities of character, are employed as coders, teleprinters and on distribution in the signals offices, and they wear the crossed flags badge of the signal service on their arms.

CIPHER STAFF

The cipher staff of each of the home commanders-in-chief is composed of W.R.N.S. officers who handle the "most secret" messages. Each one is an expert typist and teleprinter operator, and knows not only how to turn a cipher message into plain language but what to do with it when it has been deciphered.

Every naval historic action in this war has had its contribution from Wren watchkeepers, who pass the vital signals to and fro. What a tale future mothers will have to tell their children of the epic

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of Dunkirk, the River Plate, Cape Matapan and the sinking of the *Bismarck*!

And let it not be forgotten that many of these W.R.N.S. cipherers are the wives and daughters of naval officers engaged in these and similar operations. It is not unknown for a W.R.N.S. officer to receive the first news of the sinking of her husband's ship, and for her to tell no one but carry on calmly at her post.

Each of the great training establishments for the Navy and the Naval Air Arm has several hundred Wrens, and in the new establishments these have been included in the original complement of the station. At one naval air station the "ship" was commissioned when the entire "crew" consisted of forty-seven Wrens, the real ship's company having not yet arrived. The captain made naval history by addressing this novel ship's company on the commissioning of the ship, and those forty-seven Wrens were the proudest in the Service. Yarns travelling the way they do in the Navy, it was not surprising to be asked, some twelve months later, whether it were really true that H.M.S. "So-and-So" was manned entirely by Wrens.

The policy of regarding the W.R.N.S. as an integral part of the ship's company is particularly noticeable in training establishments, where ceremonial has a marked place in the order of the day. The Wrens take their place at divisions, inspections and church parades, and very inspiring it is to see them swinging past with shining eyes and chins held high. As one W.R.N.S. officer remarked: "My Wrens have a passion for marching past." They march well at all establishments where they have been given the opportunity to learn, and that commanding officer is certain to be the most critical of his Wrens' marching who has steadfastly refused to allow them to drill, asking: "Will it help them to cook or type better?" For women, as well as for men, close-order drill has been

WIRELESS TELEGRAPHY TRAINING SCHOOL
Wireless telegraphy is the chief means of communication used by ships at sea. Wrens are trained to receive messages and are most efficient at so doing

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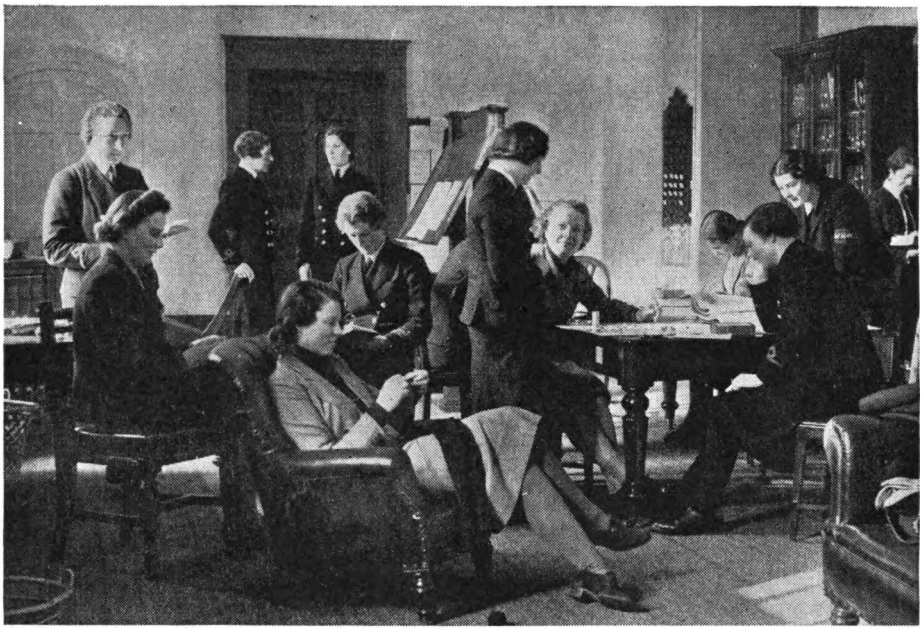
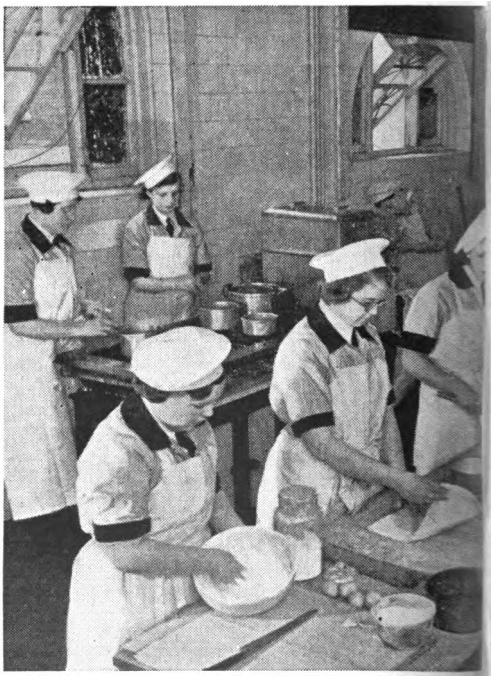


Above, some Wrens are seen relaxing in their rest-room; below, others are learning to fold parachutes for the crews of the Naval Air Arm



Members of the W.R.N.S. have taken over much of the cooking at shore bases of the Royal Navy. These girls are being

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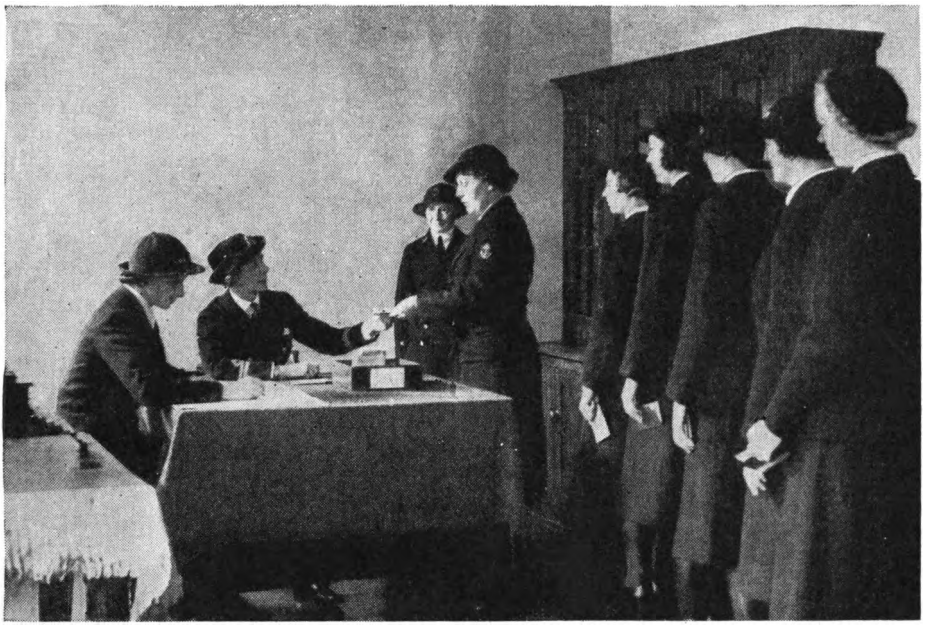

Above, Wrens mustering before an officer for their pay; below, W.R.N.S. motor cyclists are seen leaving the Admiralty with dispatches

trained as cooks at a naval cookery school for both men and women. The naval term "galley" is used instead of "kitchen"

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unquestionably proved to be an excellent promoter of a proper sense of discipline.

It is worth taking a little trouble to make these women take a pride in their uniform and feel in their bones that they belong to "the" Service—it adds romance and colour to the same job that they may have been doing for years in civil life.

INTERESTING JOBS

Of course some jobs are exciting in themselves. There are girls who think that nothing compares with careering through the streets on a motor bike at breakneck speed carrying dispatches. One had her bicycle blown from under her in an air raid, but, picking herself up and abandoning her damaged machine, she ran the remaining three-quarters of a mile to deliver her dispatch and then volunteered to go out again.

Wireless telegraphy is a branch which has many "fans." Hundreds are needed, but there has always been a waiting list. Numbers of girls who had been inspired with an enthusiasm for Morse in the Girl Guide Movement have been included among the applicants. To see a group of girls with earphones on their heads receiving and sending messages in Morse to ships is to realize how the Wrens are incorporated into the naval organization.

Wireless telegraphists were the first Wrens to proceed overseas, this pioneer group being employed at Singapore. Since then W.R.N.S. units have been established at other overseas stations.

Visual signalling is another branch which many find of absorbing interest. And the Wrens who are employed on plotting the movements of ships and aircraft, or on radiolocation, are proud to know that they are fighters in the Battle of the Atlantic and the Battle of Britain.

At the naval air stations a number of different jobs are undertaken by Wrens which they do not do elsewhere—there are parachute packers, battery chargers, bombing range markers. And a new development is the training of Wrens in various branches of aircraft maintenance —cleaning engines, testing sparking plugs, checking the parts, repairing and spraying the fabric. With the growth of aerial photography, members of the W.R.N.S. are trained to assist in this work. Instruction in the use of cameras and in the development of films is very popular.

At the beginning of the war innumerable applicants caused amusement by emphasizing their experience in boat work, sailing, and navigation, as qualifications for joining the W.R.N.S. However much one might feel that these were women with very pleasant hobbies, one had continually to harden one's heart and say that these qualifications could not be made use of, but a knowledge of navigation is invaluable for shore appointments in which W.R.N.S. officers are, to a notable extent, replacing naval officers.

It seemed startling enough, at the beginning of the war, that the W.R.N.S. were allowed to have their officers' training course at that historic centre for the training of naval officers, the Royal Naval College, Greenwich; to be part of the life of this famous home of naval tradition; to be the first women to dine in the lovely painted hall, which is a fresh inspiration every time one enters it. Now the innovation has been carried still further, and W.R.N.S. officers undergo the staff duties course at the Royal Naval College with naval officers at the same lectures and examinations.

DUTIES FOR OFFICERS

These W.R.N.S. officers will be appointed to posts ashore which would otherwise have to be filled by junior naval officers—for staff duties, as secretaries or accountant officers, in Naval Control Service offices dealing with the planning of convoy routes, originating

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and sending out signals, as plotters or assistants, in gunnery experimental work.

Apart from W.R.N.S. officers who replace, or substitute for, naval officers, administrative officers are employed in charge of personnel; they are entirely responsible, under the commanding officer, for the discipline of the Wrens, for the keeping of records and statistics, and for welfare, spiritual, mental and physical, including accommodation, food and the organization of recreation. If Wrens live in a camp, a junior W.R.N.S. officer is specially borne for supervision of the quarters and the general physical welfare of the Wrens.

WELFARE AND RECREATION

If W.R.N.S. quarters take the form of a private house requisitioned for the purpose, a W.R.N.S. officer lives in the quarters and does everything possible to make it a happy and healthy home for the Wrens and to encourage them to organize sports, dances and entertainments in their spare time. Thanks to Lord Nuffield it has been possible to supply units with such amenities as wireless sets, ping pong tables, tennis racquets, hockey sticks—and even bicycles, for remote spots where feet provide the only general mode of transport.

The spirit of some of these small stations is wonderful. To come on a small Wren unit on a wild coast or in the depths of the country, brimming over with enthusiasm and convinced that theirs is the most interesting and important job in the whole Service, is very moving. And it is not only from the work point of view that the Wrens have been a boon and a blessing in some of these isolated stations. By all social and human tenets a mixed community is the most healthy. The men of the Navy who in so much of their work are perforce removed from feminine influence, cannot but benefit from the society of these young women who take their duty to their country so seriously, who work with them enthusiastically, and who are ready to meet them afterwards on the hockey field or on the dance floor in comradely spirit.

With new members of the Service there are sometimes amusing incidents. In the early days a new W.R.N.S. officer who had been instructed to report to the captain on arrival, modestly joined the end of a queue outside the captain's office—only to discover later that she was in the defaulters' parade.

A Wren reporting to her first station after dark was startled into dumbness by the fierce voice of the sentry shouting: "Who goes there?" Once again the cry was repeated: "Who goes there?" A small, squeaky voice came out of the darkness: "Wren, friend! Wren, friend!" "Wren friend" was soon a well-known character in that station.

A recent letter from Their Lordships the Commissioners of the Admiralty to commanders-in-chief and flag officers in regard to further replacement by Wrens includes the following:—

> "I am to acquaint you that the Women's Royal Naval Service since its inception in 1939 has taken over from naval and marine personnel some 15,000 posts in shore establishments in this country, thereby releasing an equivalent number of men for combatant duties afloat, and their lordships have received with satisfaction reports indicating the efficiency and keenness of the members of this Service in their naval duties."

NAVAL NEEDS

Where will it end? That is impossible to say. It depends on the length and on the development of the war. As far as the W.R.N.S. is concerned the answer depends solely on the needs of the Navy. The Wrens are prepared to tackle any naval job which they are asked to do.

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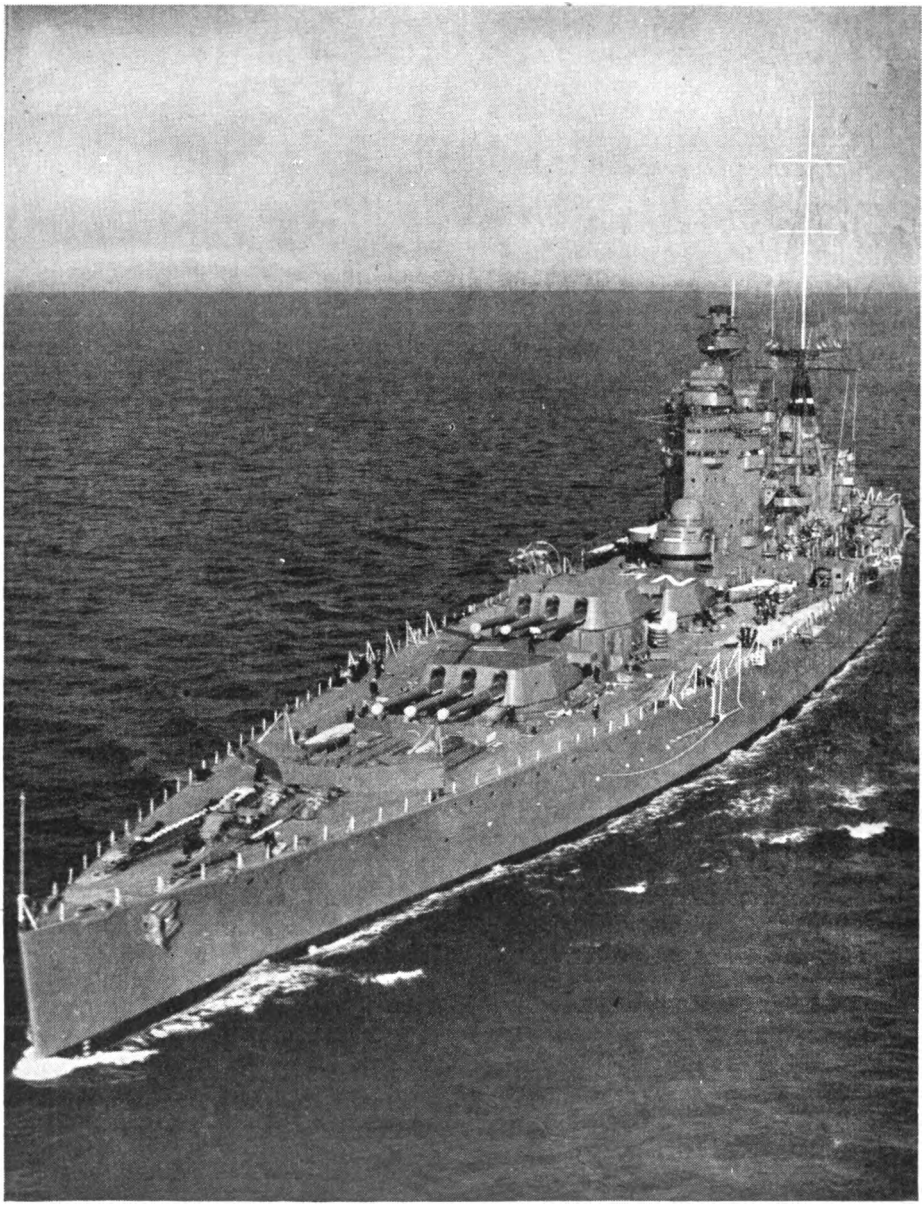

H.M.S. NELSON

H.M.S. Nelson, with her sister ship H.M.S. Rodney, represented a departure from normal battleship design when they were launched in 1925. The main armament consists of nine 16-in. guns grouped forward in triple turrets, and by placing the boiler-room abaft the engine-room the designers overcame trouble from smoke interference with the control positions. The armour is largely concentrated over the guns and magazines in the fore part of the ship, and the external bulges for underwater protection have been replaced by internal bulges

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Section 2. MATERIEL

CHAPTER 6

Battleship Construction

Contradictory rules. Why a ship floats. Displacement. Purpose of bulkheads. The double bottom. Watertight compartments. Safety bulges. Protective armour. Speed and horse-power. Skin friction. Machinery. The modern boiler. Oil fuel fires. Four-gun turrets. Electrical equipment. The anchors. Superstructure. Battleship costs

THE naval architect has to design and construct his ships according to the needs and requirements of his day. Mobility, habitability, seaworthiness and endurance must be provided in order to execute the desired strategy. Armament, protection, speed, strength and manœuvring power must be supplied to enable the admiral and his captains to carry out successful tactics on the day of battle.

As a rule some of these requirements are contradictory. The gun must beat the enemy's armour, yet the armour must defeat the enemy's guns. Each successive design must give birth to faster, more modern and more powerful ships; yet depth of water in harbours and the size of available docks are stern facts which compel the dimensions of ships to be kept within definite limits.

The selection of the most suitable materials assumes great importance. Improvements in this direction continually come to the aid of the architect, and he therefore must ever be on the alert to seize upon and to make the best use of new materials, processes, scientific progress and new inventions.

In the olden days the "art and mystery" of shipbuilding was guarded and encouraged by the Honourable Company of Shipwrights, one of the ancient and powerful guilds of the City of London. The Shipwrights' Company of today may have lost its ancient authority to guard, but it does still encourage the art especially among students and apprentices. While fashion in design changes, the principles of the science of naval architecture stand firm.

WOODEN "WALLS"

The earliest ships were made of wood. This was natural, as wood was the only known material that could be worked with primitive tools. But even after iron had supplanted wood in many important ways, ships remained the wooden walls of our ocean commerce as well as the sea protection of all maritime nations. This was not extraordinary since, with the exception of a few advanced thinkers, it seemed to the remainder of the world to be a self-evident fact; for surely, they thought, wood floats and iron sinks.

Now the first thing of which to disabuse one's mind is the idea that a wooden ship floats because wood floats in water. It is only necessary to remember that a wooden ship may carry a cargo of iron or stone and yet float. A ship floats because of its shape. The earth's gravity attracts all objects; therefore whatever we place on the surface of the water

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is pulled by gravity towards the centre of the earth and tries to sink down through the water; but to do so it has to press the water out of the way, and this it cannot do unless it is heavy enough to displace enough water to let it pass. So long as a ship is intact and is not as heavy as the amount of water that it would have to push out of the way in order to sink, it will float, whatever may be its material. The floating of a ship therefore depends on its weight and shape. The thinner the sides of a ship, made out of a given quantity of material, the greater will be its size; and, therefore, the greater will be the amount of water it will have to push out of the way before it can sink.

When we come to look at a man-of-war—say a battleship—we find that it has to have a large "displacement" of water so that the weight of the water displaced may be equal not only to the weight of its hull but also to that of all the armour, guns, engines, ammunition, water, stores, food and other necessities for living accommodation for the officers and crew.

It is reasonable therefore that the sizes of the various ships of war should be reckoned in "displacement"; that is, the number of tons of water they will displace when floating ready for service.

The following table shows how the sizes of ships increased during late years and, also, the relative weights of wood and steel ships and details of their various accessories.

The hull of the ship includes not only the side and bottom plating but also the

DISTRIBUTION OF WEIGHTS IN A FEW SHIPS

Item	*Ship-of-the-line 120 guns*	*Majestic*	*Lord Nelson*	*Dreadnought*
Designed about (year)	1841	1893	1904	1905
Complement of officers and men	820	758	750	651
	Tons	*Tons*	*Tons*	*Tons*
Officers, men and effects	102	95	95	82
Water, provisions and officers' stores	707	155	156	142
Anchors and cables	90	134	112	115
Masts, yards, boats and W.O. stores	241	253	247	251
Torpedo net defence	—	33	40	60
Ballast and tanks	373	—	—	—
Total equipment	1,513	670	650	650
Fuel on load draught	100	900	900	900
(total possible)	—	(2,265)	(2,620)	(4,150)
Machinery and stores	—	1,365	1,720	2,050
Guns, mountings and ammunitions	529	1,580	3,110	3,100
Armour and backing casemates, conning-towers and protective bulkheads	—	2,125	2,230	2,390
Barbette armour	—	1,210	800	1,260
Protective decks	—	1,200	1,170	1,350
(total protection)	—	(4,535)	(4,200)	(5,000)
Hull and fittings	2,467	5,850	5,920	6,200
Total displacement	4,609	14,900	16,500	17,900

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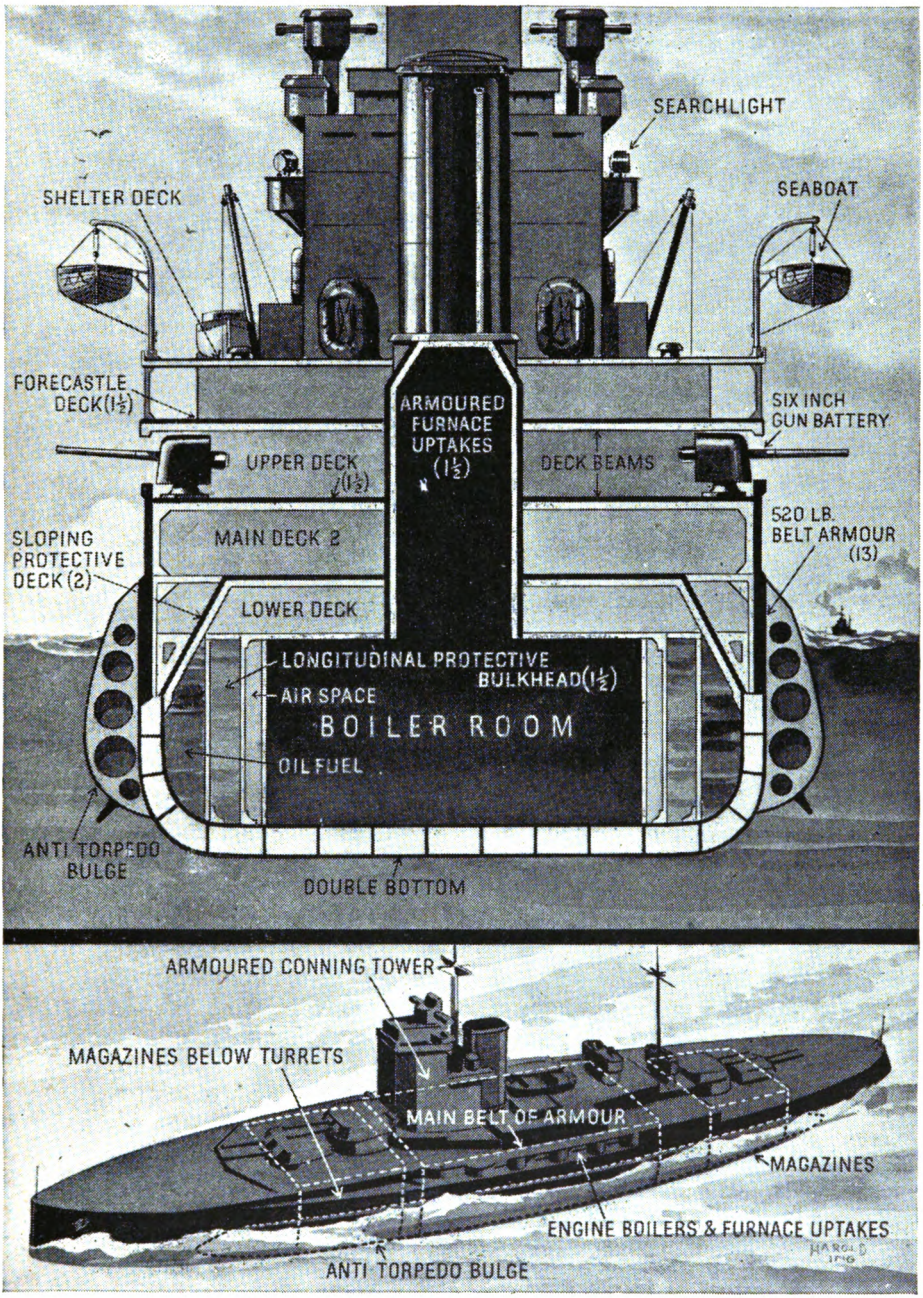

ARMOUR PROTECTION OF A BATTLESHIP

Details of the armour plating on a battleship of the Royal Sovereign class. The figures in brackets in the upper part of the diagram denote the thickness in inches of the armour plate. In later types of ship the anti-torpedo bulges are internal and thus the ship's speed is increased

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decks and the bulkheads which divide the ship into compartments. These serve a two-fold purpose. Originally they were found to be necessary to strengthen the whole structure; for the bulkheads and the beams which carry the decks, tie the sides of the ship to one another much as the inside walls and joists of the flooring bind the outside walls of a house together and keep them upright.

The bulkheads also serve another purpose, namely, to divide the ship into watertight compartments, so that in case of damage to the hull only a limited amount of water is let into the ship. The decks also prevent water from finding its way into the body of the ship. In addition to these "across the ship" bulkheads, called "transverse" bulkheads, there may also be "longitudinal" bulkheads; which—as their name indicates—run lengthways. Some even extend for the whole length of the machinery spaces.

Yet another form of subdivision is provided in a ship-of-war by the double bottom. This is formed by a second skin being built to cover the framing of the outer bottom of the ship, so that if she is damaged by running ashore there is a considerable chance that this inner bottom will remain intact and prevent water entering the hull. The space between these two bottoms, called the "double bottoms," is again divided by watertight frames so that only a small portion of this space may be flooded in case of damage to the outer skin.

DAMAGE BY GROUNDING

This subdivision of the ship is all right in theory, and is the best that can be done in practice to keep the ship afloat in case of damage by grounding or during an action, but it is by no means perfect. Let us see why.

Imagine a hole to be made in the bottom of a ship by a torpedo or mine, and water to be admitted into a compartment on the port side of the ship—say about three-quarters of the way from the bow to the stern. Naturally the compartment will fill with water. This means that the ship will have lost some of the support that the sea gave to this part of the hull. The loss is, in fact, just as great as if we had filled the compartment with water without the hull having been damaged. We may therefore look on it as if weight had been added to this side of the ship.

CORRECTION BY FLOODING

The ship will naturally heel over towards this side; it will sink a certain amount bodily in the water, and will also tip a bit down by the stern. If we try to correct the "heel" and the "tip" by flooding a compartment on the other side of the ship forward of the centre, we may indeed do away with both of these troubles and bring the ship upright. But, in so doing, we shall have lowered the ship bodily in the water twice as much as if one compartment only had been flooded. There is, naturally, a limit to playing fast and loose in this manner with the buoyancy of the ship.

Theoretically the smaller the watertight compartments the less chance is there of a ship sinking through damage to her hull. But a ship has to be lived in; boiler- and engine-rooms have to be of a certain size, and many other points which affect the "habitability" of the ship have to be taken into account. In the case of damage by a torpedo or a mine, one of the transverse bulkheads as well as the outer skin may be damaged, so that water may be admitted to two or more compartments on the same side of the ship. To attempt in such a case to upright the ship by flooding other compartments might mean that a dangerous amount of water would be allowed to enter the ship. It is evident, therefore, that although watertight compartments are an aid to security, they cannot confer absolute immunity

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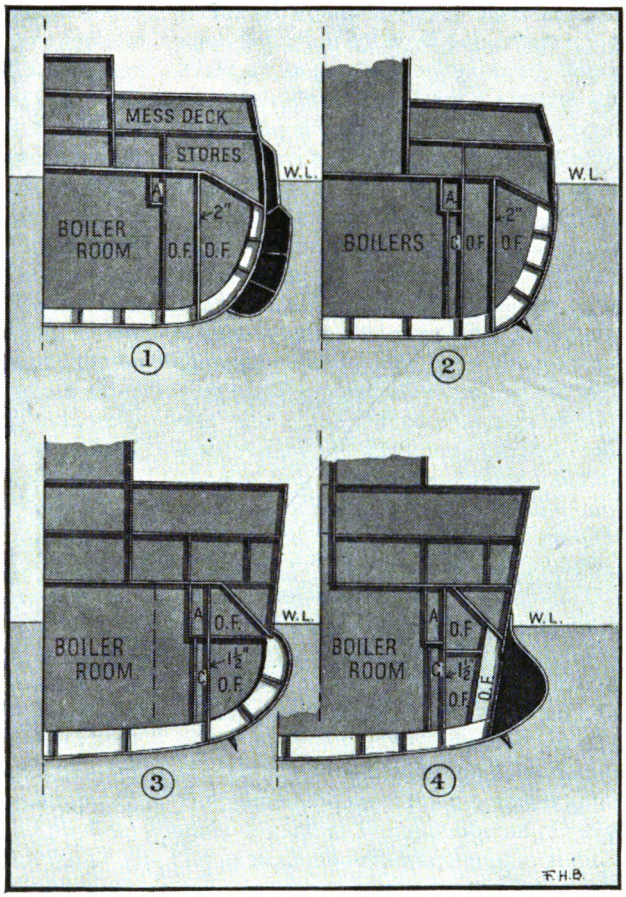
from the danger of capsizing or sinking after severe damage has been incurred.

Another method of helping a ship to survive below-water damage is to fit her with bulges (Fig. 1). These form an additional skin built at a distance from the ship's side, say six to fifteen feet. A torpedo that would have struck the hull plating proper is, by this means, exploded at a distance from it, and so a considerable degree of safety is afforded by the bulge. There are, however, two outstanding objections to such a fitting—the volume of the ship which must be pushed through the water is increased and her speed correspondingly decreased, and ships of great beam might be made too broad to enter existing docks.



ANTI-TORPEDO BULGES

Fig. 1. *Types of bulge protection. 1, As fitted to some completed ships; 2, internal bulge; 3 and 4, other built-in types. The letters denote* A, *ammunition passage;* C, *cofferdam;* O.F., *oil fuel. The figures indicate thickness of armour plate*

One most important item in the construction of a man-of-war is the protective armour. Armour is provided on the sides of the ship just above and just below the waterline to protect what are called the "vitals" of the ship, such as engines, boilers and magazines. This sort of armour in some of our modern ships is continued right to the bow and stern, but is a bit thinner at the ends than amidships. This extension is provided to make the end compartments less vulnerable to shell fire. Amidships it may be as much as fifteen inches in thickness, tapering to six inches or less at the ends. The armour amidships is also extended upwards, but is less thick, to protect the centre portion of the ship to as great a height as possible. An armoured deck is built across the ship to connect the thick armour on the sides.

There are armoured decks extending over the forward and after parts of the ship. These are generally at a lower level than amidships. Latterly on our larger ships an armoured upper deck is fitted to defeat bombing. In H.M.S. *Nelson* this

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armour is up to 6½ in. thick. It will be appreciated that in order to resist bombs a deck need not be so strong as the vertical armour must be to resist shell fire, since a bomb rarely attains a velocity of over 800 feet a second. It is not fired from a gun, so it has no "initial" velocity. It merely has the same speed as the aeroplane and gathers further velocity as it falls through the air; and, at the same time, it is impeded by the friction of the air. Its punching power cannot therefore be properly compared in intensity with that of a projectile fired from a heavy gun.

The heavy gun positions are also heavily armoured, and one or two protected conning-towers are provided. In the *King George V* class of ship the armour accounts for 14,000 tons out of a total displacement of 35,000 tons.

Having now described the general features of the hull of a ship, let us turn to the question of the behaviour of a ship at sea. At Fig. 2 (A) is shown a cross-section of a ship floating in water. Its centre of gravity is at G—the point at which, if it were possible to suspend the ship, it would balance evenly without tipping in any direction. The weight of the ship is pulling straight down from G, and the water is pressing up all over the bottom C, D, B, F, E, and supporting the ship.

INITIAL STABILITY

If now we look at Fig. 2 (B) we shall see that the ship has been heeled over, and that much more water has been now displaced by the ship on the right-hand side, E, F, B, than on the left-hand side, C, D, B. The result is that there is a greater "push" up on the right side, and the ship tries to become again upright. In Fig. 3 we see a wave meeting a ship. If the ship has a lot of "initial stability," that is, if it is able to *keep itself at right angles to the surface of the sea* (in this case the surface of the wave), then the ship will roll. At X it will roll to the right; as the wave passes, it will, at Y, come upright to the earth again, and at Z it will roll to the left.

So we see that the more "stable" a ship is the more she will try to keep her masts normal to the surface of the waves; she may be safer, but she will be more ready to roll. If, as in Fig. 4, she had but little righting capacity she would not make such efforts to remain at right-angles to the surface of the wave, but would be liable to remain at right-angles to the surface of the *earth* instead of the surface of the *sea*. She would then roll more, but would be less able to resist heeling and consequently not so safe.

PENDULUM MOVEMENT

These, of course, are general considerations. In practice a ship is a stately structure having a considerable weight, so that it cannot bob about like a cork. It takes some appreciable time for the wave to cause it to begin to move, or to stop its moving. When the ship does move it behaves very much like a pendulum; it has a tendency to swing slowly backwards and forwards, or rather to roll to and fro with a rhythmic motion.

When, therefore, a wave causes it to begin a roll, the ship will always be a bit behind what it would have been had it been a mere cork; and, similarly, it will be behind in rolling back. When, however, several waves follow each other in succession at a rate that suits the pendulum motion of the ship, she will roll farther, and farther, and farther, since each wave as it passes gives her an impetus at the right moment. All who have been at sea know this sort of motion well. A roll, then a rather bigger roll, then a bigger one still, then a smaller and smaller one. It is lucky that large waves following each other rarely have precisely the same length or "period," otherwise a ship whose shape and position of centre of gravity suited that particular

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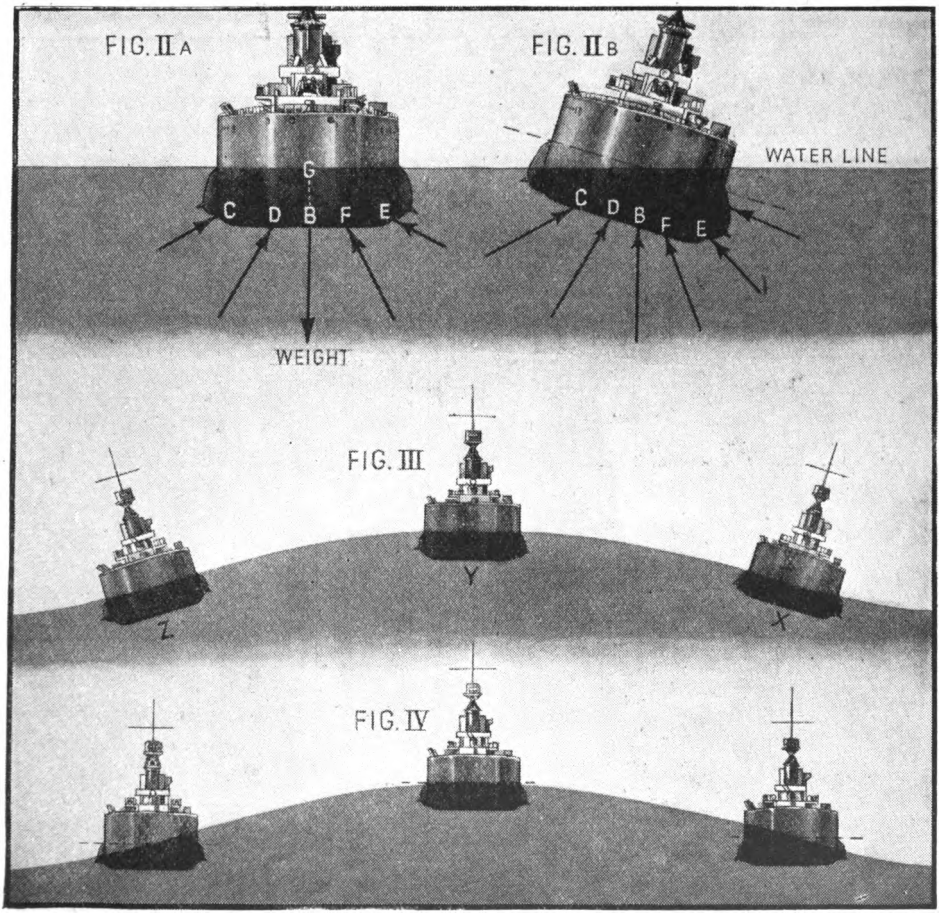
period would be liable to roll very heavily indeed and perhaps even to capsize.

Now the importance of these considerations, as regards the fighting qualities of a ship, is due to the fact that a ship must be stable and have good righting qualities, otherwise very little damage may cause her to capsize; but, at the same time, she should not roll unduly, as this would cause her to be a bad gun platform and make accurate shooting difficult. The naval architect has to steer a mean course between these requirements, and well indeed does he do so.

How many people lying in their bunks at sea, with the ship tossing, pitching and rolling, appreciate that all those motions have been studied by the naval architect and allowed for in the design of the ship, so that she may be not only a safe ship but a strong ship, able to meet all the straining actions which occur at sea?

When a ship is steaming across waves, the positions when maximum stress on



BEHAVIOUR OF A SHIP AT SEA

Fig. 2 A, *Cross section of floating ship with centre of gravity at* G. **Fig. 2 B,** *Ship heeled over with consequent displacement of more water on one side.* **Fig. 3,** *Wave meeting a ship, showing how a stable vessel tends to keep perpendicular to the wave and so appears to roll.* **Fig. 4,** *A more unstable ship tries to keep her masts at right angles to the earth's surface*

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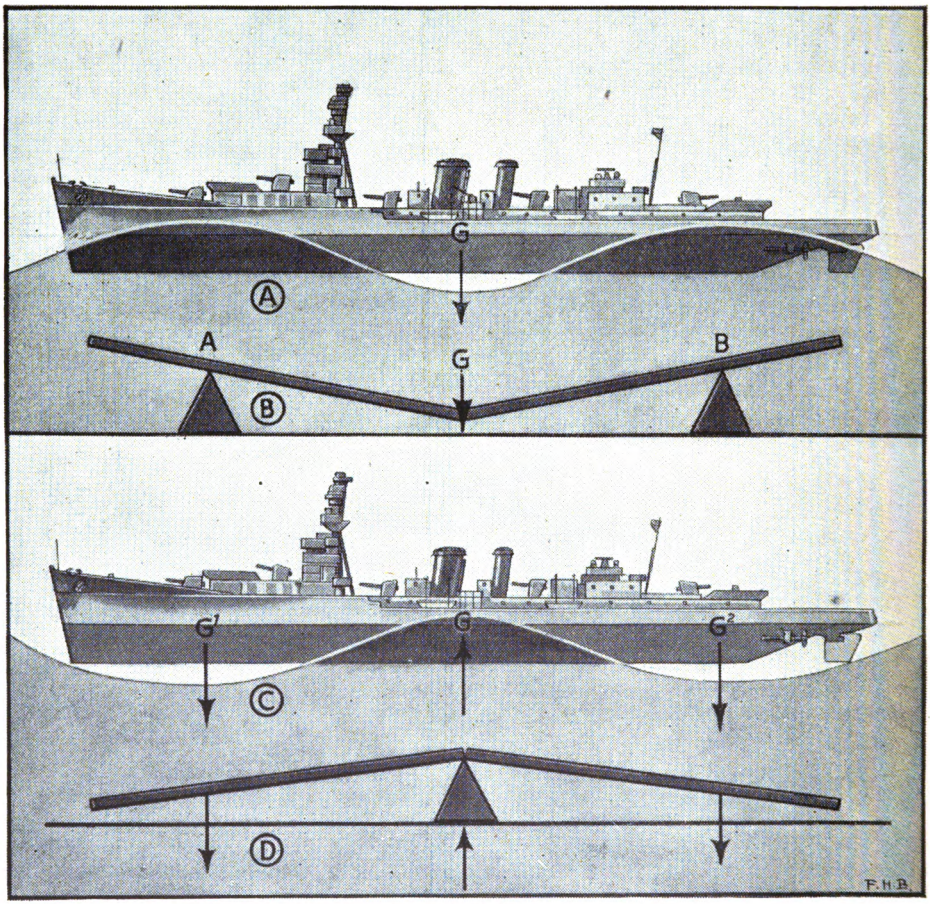
the hull occurs are as shown in Fig. 5. We can imagine the ship for the moment divided into two halves; each of these has a point about which it would balance if free to do so, exactly in the same way as we have seen that the whole ship would balance about its own centre of gravity.

These two points are marked at G^1 and G^2, Fig. 5 (C). G is the position of the centre of gravity of the whole ship. If, now, two waves come rolling along, and, for a moment, one is under the bow while the other is under the stern of the ship, the centre part is left to some extent unsupported. The result is that this unsupported weight of the ship at G tries to drop the centre and break it; as a long rod, if weak, would break at G if supported at A and B Fig. 5 (B). It is then said that the stress tries to "sag" the centre of the ship.

The second position of stress is when the centre of the ship is supported on a wave and the ends are not, as in Fig. 5 (C) or, to use the analogy of the rod again, like a weak rod supported in the centre



MAXIMUM STRESSES ON SHIPS' HULLS

Fig. 5. *A ship is subjected to considerable stresses when pitching in a heavy sea. The maximum strains are as shown above. At* A, *the bow and stern are lifted by the waves, leaving the centre unsupported. At* C, *the centre is lifted on the wave crest, leaving the ends unsupported*

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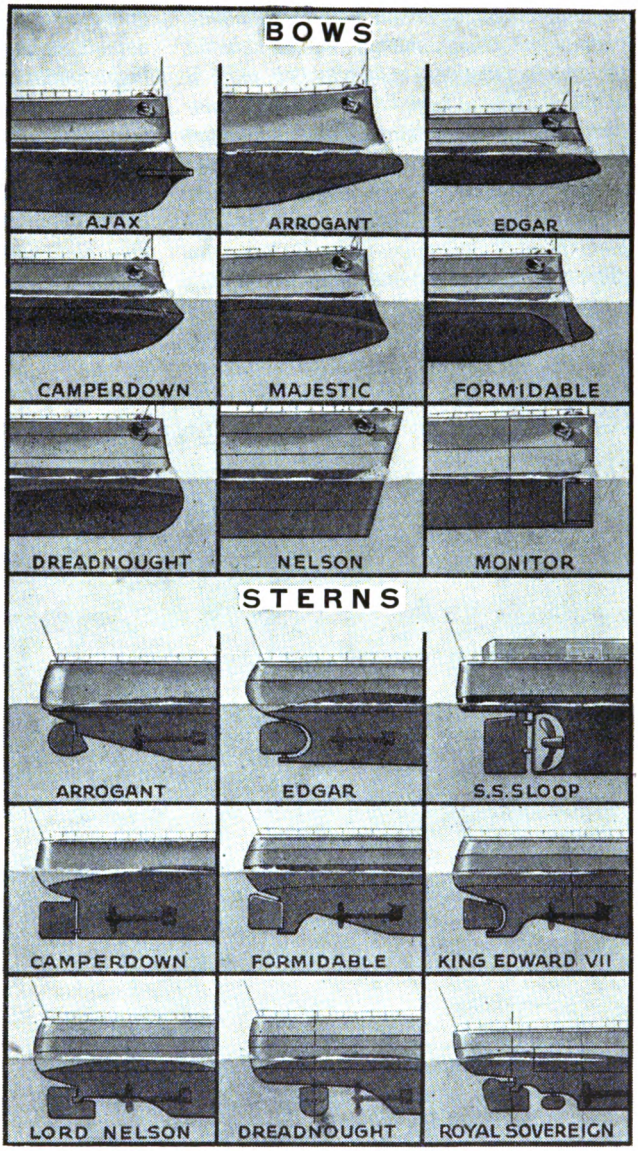
as at Fig. 5 (D). The bow and stern tend to drop and the ship to become "hogged," that is, shaped like the back of a wild boar. These stresses are particularly important when considering the design of a man-of-war, in which the heavy turrets and their accessories are situated towards the ends of the ship, and the heavy boilers, fuel and engines, occupy the centre. The plating of the hull is strengthened where necessary to deal with these stresses.



VARIATIONS IN BOWS AND STERNS

The shape of the bows and stern of a ship considerably affect its speed, and design is constantly changing in order to meet certain special requirements. Some typical shapes of bows and sterns in various battleships, past and present, are shown here

SPEED

The speed that a ship will attain and the horse-power required to obtain a given speed are determined before the ship is built, from experiments carried out in a long tank. A model of the ship is made in wax and this is towed by an apparatus which records the resistance of the model to its passage through the water. From these records the performance of the full-sized ship can be accurately forecast.

When watching any object being pulled or propelled along the surface of the water a certain ripple at the bow will be observed. This is called the "bow wave," and it will be seen that it increases in size the faster the object is propelled. Such waves, raised by a ship steaming fast, absorb most of the power of the engines. An amount of water equal to that displaced forward by the bow of the ship also flows

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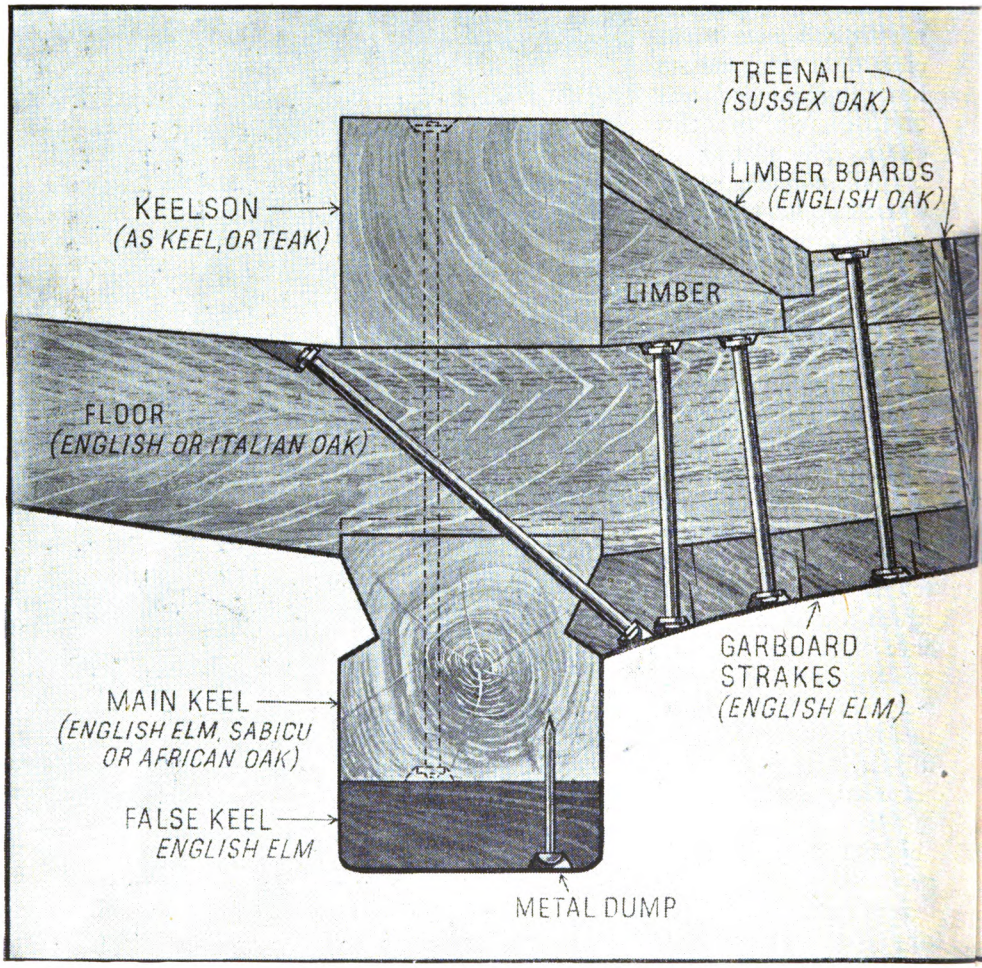
in at the stern, and in a well-formed ship pushes her ahead, so that the net amount of power required to drive the ship is reduced. There is a limit to this reduction, but the fact remains that the more perfectly the ship enters the water ahead of her without fuss, and the better the shape of the stern, the less power will be lost through wave motion. In practice, after the best has been done to effect a good design very considerable power is expended in this wave-making, which at high speeds exercises a great check on the speed of the ship through the water.

Another check to the ship's speed when steaming is "skin friction," that is, the rub of the water against the bottom. A fish is provided with means of oiling its skin, and it also can alter its shape according to its speed so that it may experience



BACKBONE OF A WOODEN SHIP OF THE

Although the "wooden walls" have now been superseded by iron and steel, the battleship designer of today owes much to the old shipwrights who laid down the first principles of the science of naval architecture. For purposes of comparison with the more modern ships illustrated in later pages, we reproduce above a section through the keel and lower portion

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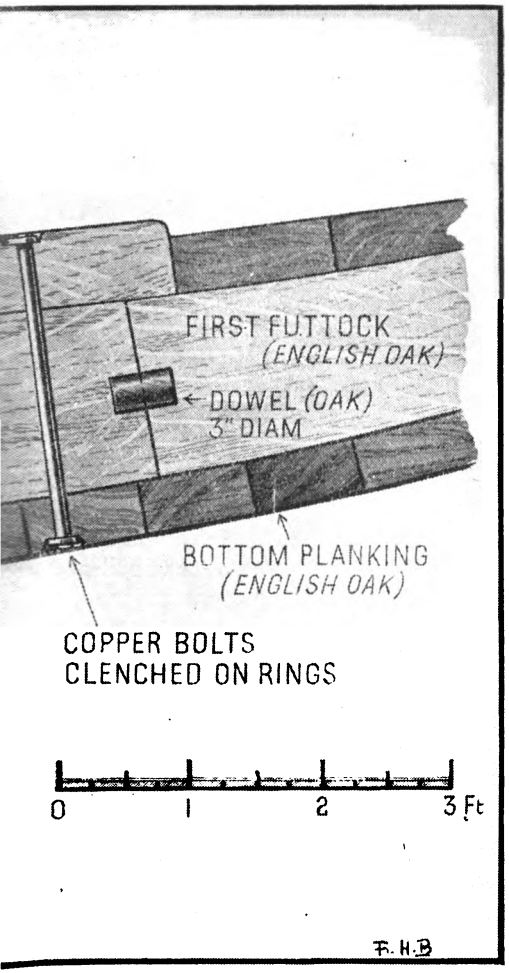
the least resistance possible when passing through the water, with the result that it moves with very little expenditure of power. A ship can do neither of these things. Its bottom is rough, in fact it actually drags a thin film of water along with it, and its shape is rigid and unalterable. After even a comparatively short time in harbour or at sea, weed and barnacles attach themselves to the under-water parts and so further increase the friction and therefore waste of power.



LINE—120 GUNS

of a wooden ship of the line showing the materials of which the main members were made and how they were structurally fitted and held together by copper bolts

The state of the sea may also detrimentally affect the speed of a ship. When steaming against a head sea there is a tendency for the bows to fall, or "pitch" and dive into the bottom of the on-coming wave, when, of course, a considerably greater resistance is met with than when steaming in smooth water. The longer the ship the less seriously will it pitch in an average sea, so the less will the ship be stopped. It will therefore be appreciated that the bows of the ship must be very carefully formed so as to cleave the seas gently and make the loss by such resistance as small as possible. A well-formed bow also helps to keep the ship dry and comfortable at sea. Also, in order to maintain high speed in a seaway the longer the ship is made the better.

The next important matter to deal with is the machinery for propelling the ship. Until the advent of the original modern Dreadnought (it is necessary to say "modern" as there have been several earlier dreadnoughts), the big ships were all driven by reciprocating engines, that is, engines that had pistons, piston rods and connecting rods which travelled up and down once for every revolution of the propeller shaft. For safety during an action the engines and boilers were placed below the armoured deck.

OLD-TYPE ENGINES

Instead of being able, like the engines of a merchant ship, to have considerable height, and therefore a long, steady "stroke" (as it is technically termed), they had to be designed with a short stroke; therefore, in order to develop the requisite power they had to run at a proportionately higher rate of revolution. The heavy pistons and other moving parts had to be stopped and restarted at the top and bottom of each stroke, at least once every half-second when the

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engines were running at full speed. This brought very considerable stresses on the bearings, which was a considerable source of anxiety to the engineer officer in charge. In fact, after a full-power run of only four hours the reciprocating engines of a man-of-war sometimes required a considerable amount of overhaul and readjustment. Contracts for engines required full speed for eight hours, and half-speed for thirty hours. If driven beyond these limits difficulties were likely to arise.

A fast steaming trial was carried out by the Second Cruiser Squadron in November, 1915, from Sandy Hook (New York) to Gibraltar. All the ships were fitted with triple expansion reciprocating engines. The contract limits were considerably exceeded, and for a month afterwards the whole squadron was out of action while the engines of the ships were being readjusted. This in no way reflects on the engineer officers and their staffs; the trouble was due to the difficulties inherent in high-powered reciprocating engines of a shortness of stroke necessary to permit of the engines being housed below the waterline.

The horse-power of an engine is dependent on the pressure of the steam, the area of the pistons, the number of revolutions and the length of stroke of the pistons. If this length is restricted, then for the same steam pressure, either the size of the pistons or the number of revolutions, or both, must be increased.

The engine-room during a full-power run was liable to be an inferno. The noise in some engine-rooms was such that even messages shouted close to the ear were hardly distinguishable. In bad cases the whole place was murky with steam escaping from glands; water was splashed about from the jets of hoses playing on bearings which showed signs of heating; the place resembled a cross between an inferno and a snipe marsh.

The advent of the modern Dreadnought ushered in the turbine as the main propelling engine, and the whole scene was changed. When the ship was running at full speed it was difficult to tell that the turbines were moving; a very slight deep murmur, hardly perceptible, was the only sound, and the engine-room was as clean and bright as if in harbour. In fact, the turbine had wrought a miracle, and the efficiency of our ships of war was increased beyond belief. Ships could then be much more surely relied on to steam without breakdown, a virtue of tremendous importance to the Navy, and strategic problems became simplified.

The boilers may be regarded as large kettles for boiling water. In the old-fashioned type the hot flames and gases were taken through tubes surrounded by the water. In the modern boiler the process is completely reversed and the water is taken through small diameter tubes, surrounded by the hot flames.

The result is that a very much greater surface of water is exposed to the hot flames and gases, and steam is supplied much more rapidly. Comparatively little water is required as compared with that required in the old "tank" type of boiler; and, so long as fresh pure water is used, the small tubes require no cleaning. Steam can be raised with safety in a shorter time, and consequently sudden variations in speed can be more quickly dealt with. In addition there are great advantages gained by the considerable saving of weight and space.

OIL REPLACES COAL

The heat in the furnaces is now supplied by the burning of oil fuel. This has proved to be a considerable advance over coal. Not only is the work in the stokehold reduced to a minimum, but no longer is it necessary for the stokers to strip to the waist and shovel coal on to the fires almost continuously during a

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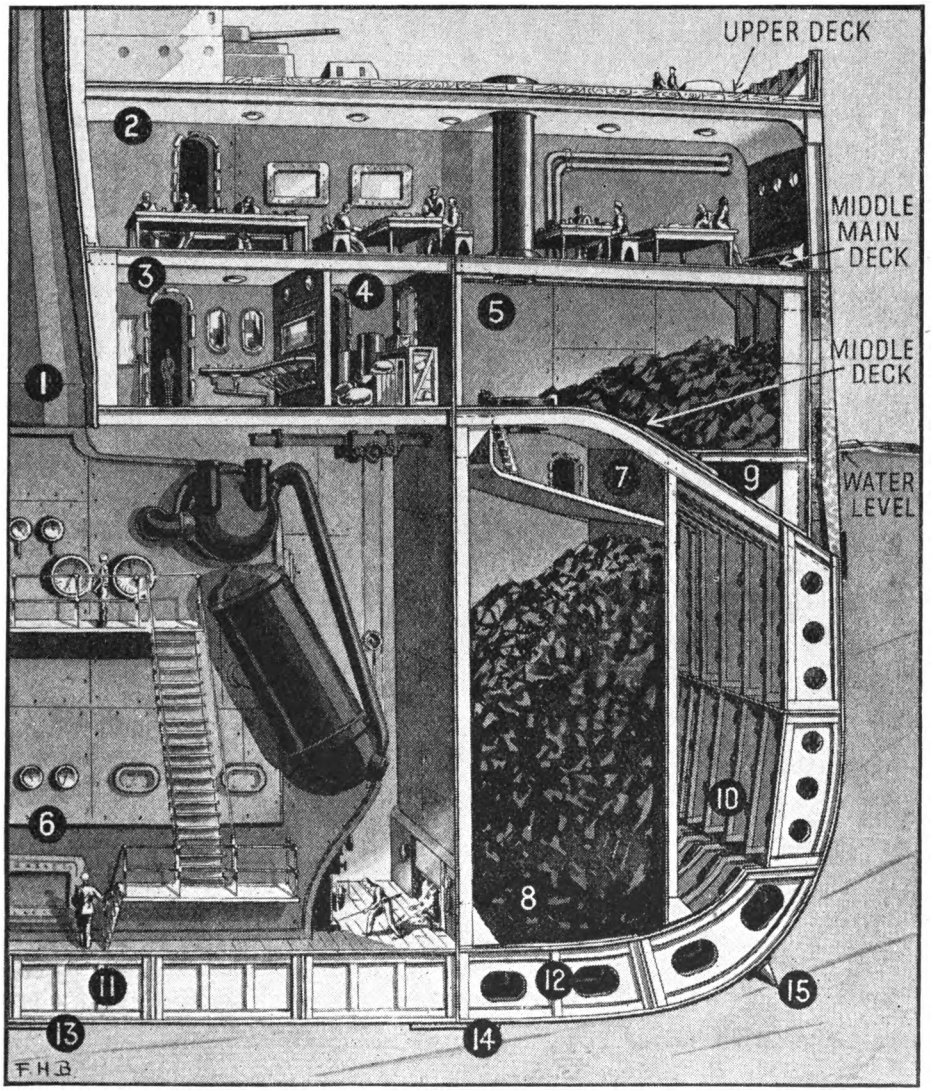
full-speed run; and no longer is it necessary to employ large numbers of men in the bunkers to shovel coal from the distant bunkers to those in ready use and thence to the ordinary stokeholds.

The flames of the oil-fuel fires can be adjusted by the manipulation of jets of air under pressure. The horrors and dirt of coaling ship are avoided. Emergency fuelling at sea is greatly facilitated, a great



MIDSHIP SECTION OF H.M.S. DREADNOUGHT

1, Funnel uptake; 2, mess deck; 3, wash places; 4, stores; 5, coal bunker; 6, boiler-room; 7, escape trunk; 8, coal bunker; 9, watertight compartment; 10, reserve bunker and watertight compartment; 11, double bottom for oil or reserve feed water; 12, oil space; 13, outer flat keel; 14, docking keel; 15, bilge keel. A later type of capital ship is shown on page 109

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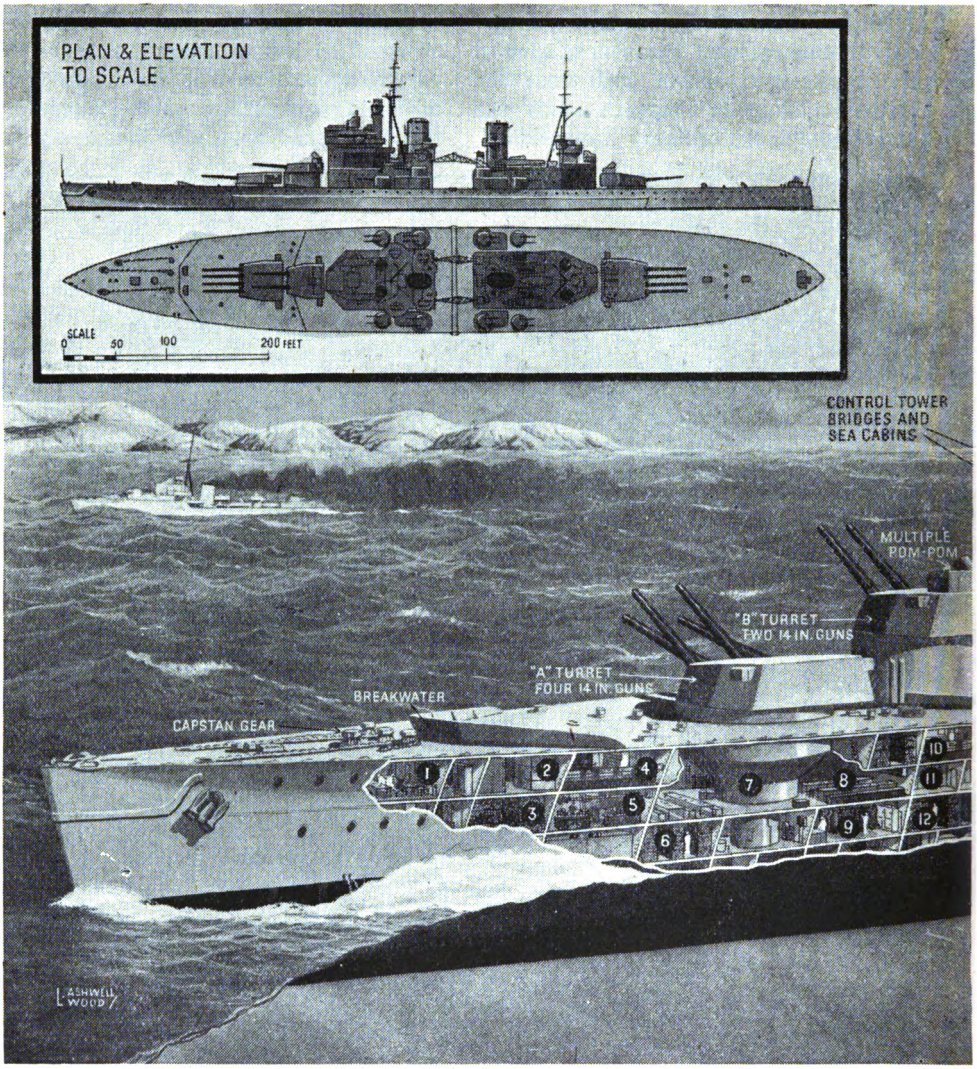

LAYOUT AND CONSTRUCTIONAL DETAILS OF

Ships of the King George V class all have a displacement of 35,000 tons and are powered by 152,000 h.p. geared turbines which give them a speed of more than thirty knots. They are armed with ten 14-in. guns mounted in two quadruple turrets and one double turret. and have a

saving of weight in fuel occurs, and the use of the double bottoms for oil bunkers has come as a boon to the naval architect.

Against these advantages the plea has been advanced that we have no oil deposits in this country, while we have abundance of coal, and that in wartime we might be starved of this essential through attack by the enemy on our transport routes. This argument is weak when we come to consider that oil is no more difficult to transport than food. If ships can bring food they can bring oil. If we could not keep up our food supplies

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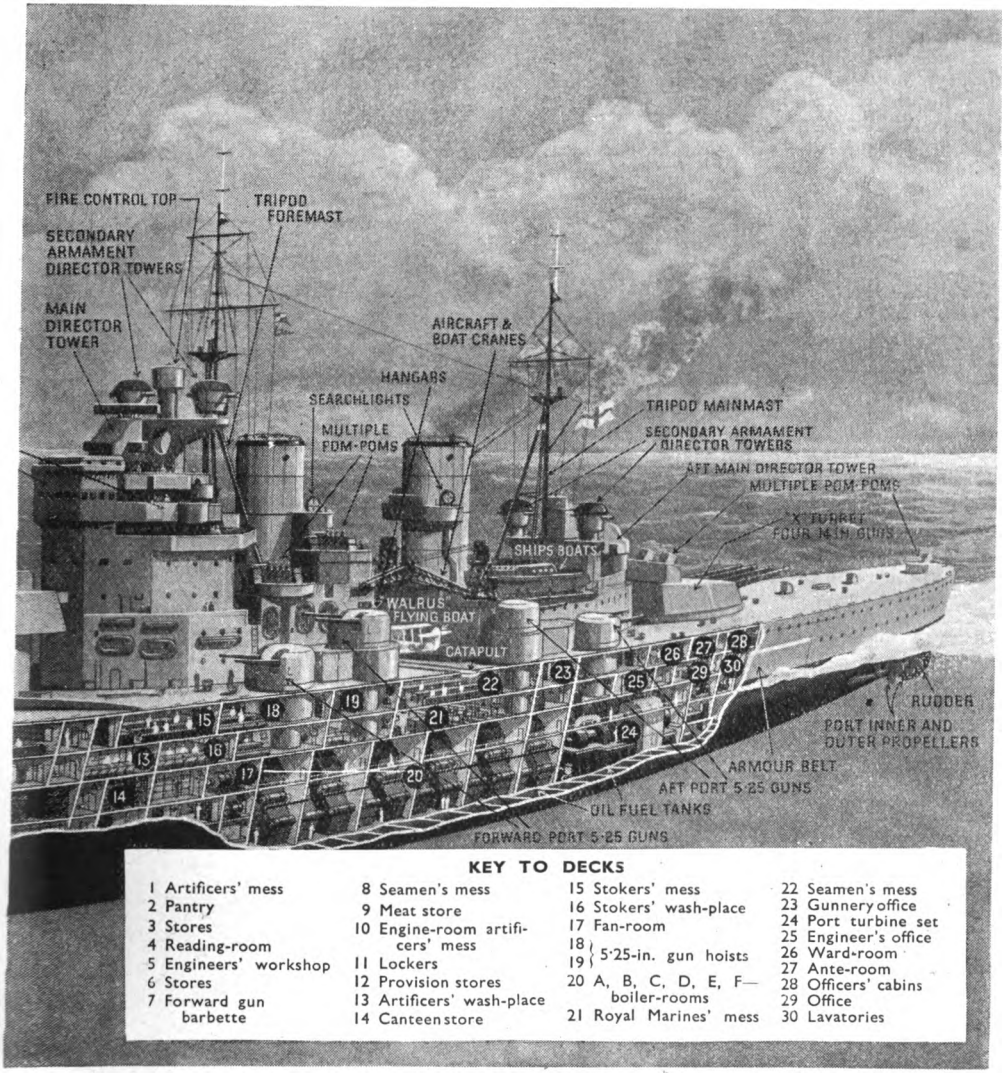

A SHIP OF THE KING GEORGE V CLASS

secondary armament of sixteen 5.25-in. guns as well as various weapons for defence against aircraft. The 14-in. guns are of new design and have a greater range than the 15-in. guns mounted in earlier ships. No torpedo tubes are fitted. Four aircraft can be carried

we should starve. Then it would not matter one iota whether what was left of our Navy had oil or not; for, obviously, the major part of our strength at sea would have been swept off the water. The alternative is to perfect apparatus for deriving oil from our coal measures.

The armament, speed and armour protection of a class of ship are fixed by the Board of Admiralty, of whom the Controller and Third Sea Lord is responsible for the building of the ship. When these details have been decided on, the naval constructors have to translate them into

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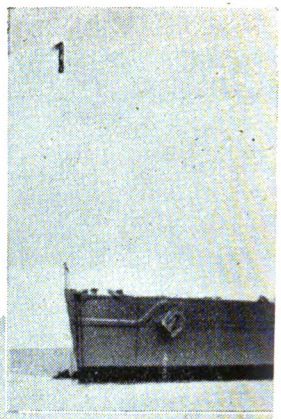
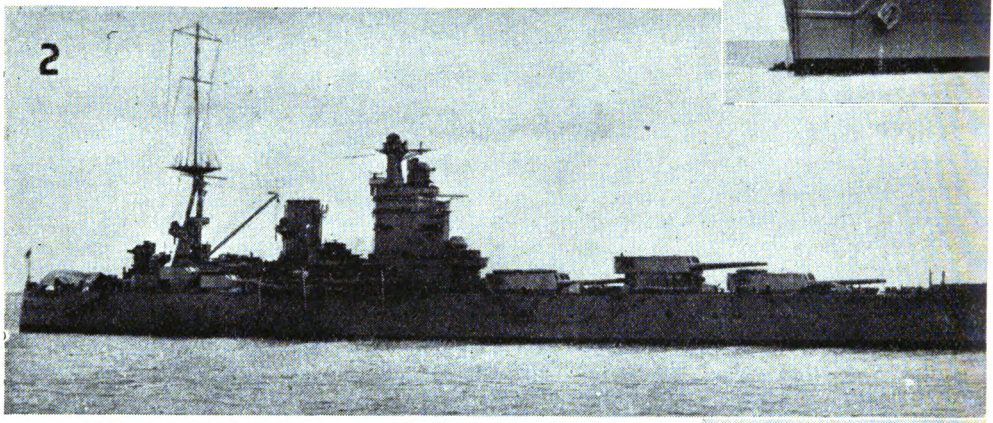
CAPITAL SHIPS OF THE ROYAL NAVY

The Royal Navy has four classes of battleships and a single battle cruiser at present in commission. Typical ships of each class are illustrated below and particulars given in each case of the name ship. Other ships of the class may vary slightly in appearance and other details from the prototype, but the essential features are the same.

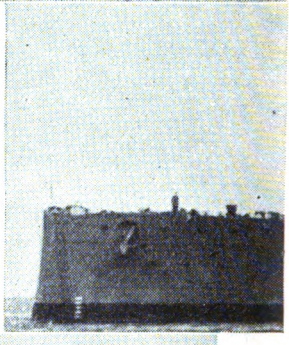
1. "KING GEORGE V" CLASS. *Displacement :* 35,000 tons. *Main armament :* ten 14-in. guns in two quadruple and one double turret. *Secondary armament :* sixteen 5.25-in. guns. *Aircraft :* four. *Dimensions :* Length, 740 ft.; beam, 103 ft. *Machinery :* geared turbines, four shafts = 152,000 h.p. *Speed :* Over 30 knots. *Complement :* 1,500.

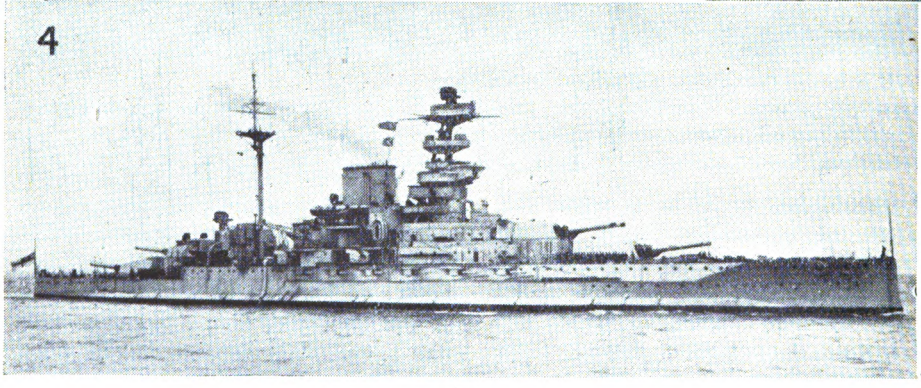




4. "QUEEN ELIZABETH" CLASS. *Displacement :* 30,600 tons. *Main armament :* Eight 15-in. guns in four double turrets. *Secondary armament :* Eight or twelve 6-in. guns and eight 4-in. A.A. guns. *Aircraft :* Four. *Dimensions :* Length, 644 ft.; beam, 104 ft. *Machinery :* Geared turbines, 80,000 h.p. *Speed :* 24 knots. *Complement :* 1,100. H.M.S. Warspite differs completely in appearance from rest of her class.

5. "RENOWN" CLASS (battle cruiser). *Displacement :* 32,000 tons. *Main Armament :* six 15-in. guns in three double turrets. *Secondary armament :* eight 4.5 dual-purpose and twelve 4-in. *Aircraft :* Four. *Dimensions :* Length, 794 ft.; beam, 103 ft. *Machinery :* Geared turbines, four shafts = 120,000 h.p. *Speed :* 29 knots. *Complement :* 1,200.





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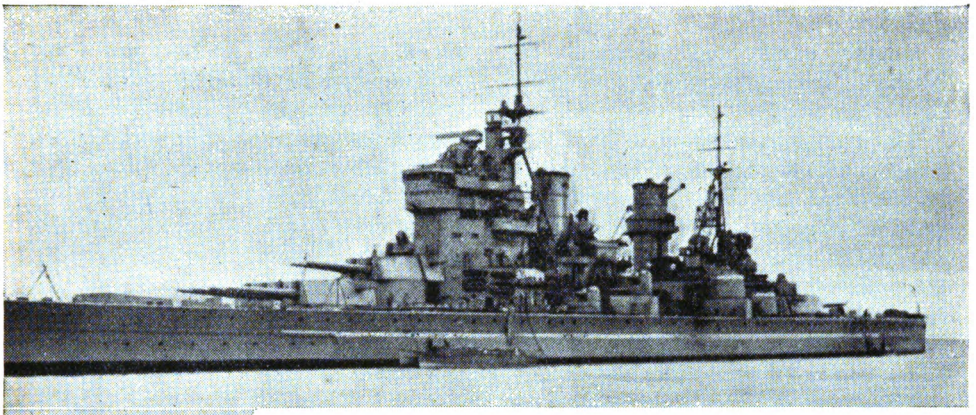
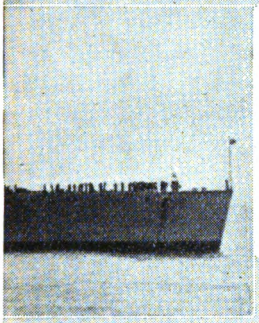
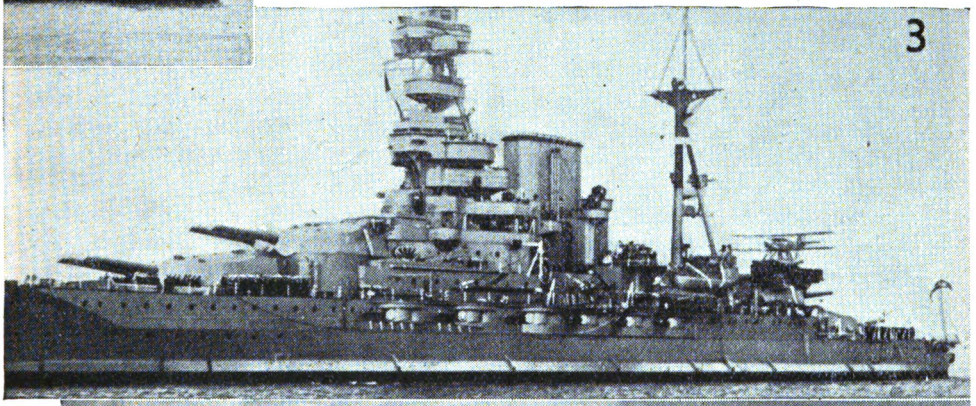
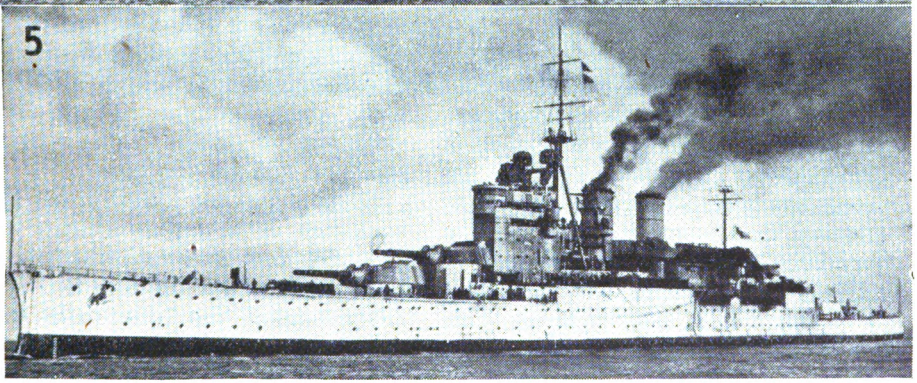




2. "NELSON" CLASS. *Displacement:* 33,900 tons. *Main armament:* nine 16-in. guns in three triple turrets, all forward. *Secondary armament:* Twelve 6-in. and six 4.7-in. A.A. *Aircraft:* One or two. *Dimensions:* Length, 710 ft.; beam, 106 ft. *Machinery:* Geared turbines, two shafts=45,000 h.p. *Speed:* 23 knots. *Complement:* 1,300.

3. "ROYAL SOVEREIGN" CLASS. *Displacement:* 29,150 tons. *Main armament:* eight 15-in. guns in four double turrets. *Secondary armament:* Twelve 6-in. and eight 4-in. A.A. *Aircraft:* One. *Dimensions:* Length, 620 ft.; beam, 102 ft. *Machinery:* turbines, four shafts=40,000 h.p. *Speed:* About 22 knots. *Complement:* 1,100.





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a suitable design and determine the tonnage, horse-power and estimated cost of the ship.

The main considerations to be kept in mind when fixing these fundamental requirements are, first, to ascertain if possible what other nations are doing in the way of ship design, next, to survey the experience gained during the period from manœuvres, gunnery exercises and firings, and, of course, any war experience either in our own or other navies.

The size of the large guns for the main armament has varied since H.M.S. *Dreadnought* from 12-in. to 16-in., and in recent ships seemed to have been stabilized at 15-in.; the latest designs, however, seem to have gone back to 14-in. This appears to be a good balance between weight of gun mountings, armour and ammunition, and the armour-piercing capacity of the guns at battle ranges.

Two-gun turrets for many years held the field, largely from the point of view that it was considered to be unwise to risk too many eggs in a single basket, so multiple turrets of three and four guns were avoided. Latterly, however, four-gun turrets have come into favour, and a saving of weight has been effected.

The original H.M.S. *Dreadnought* used to carry ten 12-in. guns. Six fired ahead, six to eight fired right astern, and eight on either beam. H.M.S. *King George V* fires six ahead, four astern, and all ten (14-in.) on either beam.

PLACING OF TURRETS

Good all-round gunfire is important, but in some cases statutory limitations of displacement compelled designers to accept arrangements which were open to criticism. Good stern fire may at times be very important when warships have to manœuvre for position, to act as decoys, or to escape from superior forces. This was well shown at the prelude to the battlefleet action at Jutland during the war of 1914-18. For an hour and a half the four ships of our Fifth Battle Squadron were engaged by the whole of the ships of the German High Seas Fleet—or rather such of them as were within range—and, naturally, our ships did their best to run away as fast as they could to join the main body of the Grand Fleet, all the way fighting an astern action. It is always dangerous to generalize on a subject so open to doubt and at the mercy of chance as a fleet action.

THE SHELL ROOMS

The installation of gun-power by no means ends with the turret. It has many important and heavy adjuncts. The turret has moving with it a "working chamber" and a trunk which goes down to the bottom of the ship. Through this trunk the ammunition is brought up behind the guns ready for loading. The magazines and shell rooms are kept down as low as possible, and generally on the centre line of the ship. The magazines are all fitted with cooling apparatus to keep them at a low temperature; a most important matter for the life of the cordite, especially in the tropics. Its safety from spontaneous combustion is dependent on it being kept at moderately low temperatures.

The secondary armament of our modern battleships is composed of "dual purpose" 5.25-in. guns (that is, guns that can be used for surface or A.A. attack), mounted in twin electrically worked turrets on the weather deck. They have their own magazines and shell rooms. Besides these, there are varying anti-aircraft armaments of smaller calibre dual-purpose guns and machine guns.

No torpedoes are carried in our latest battleships, as the torpedo is useless when fired at modern battle ranges at ships of a speed nearly that of the torpedo.

The engine- and boiler-rooms are a trouble to the designer, since normally they are large spaces which, if flooded,

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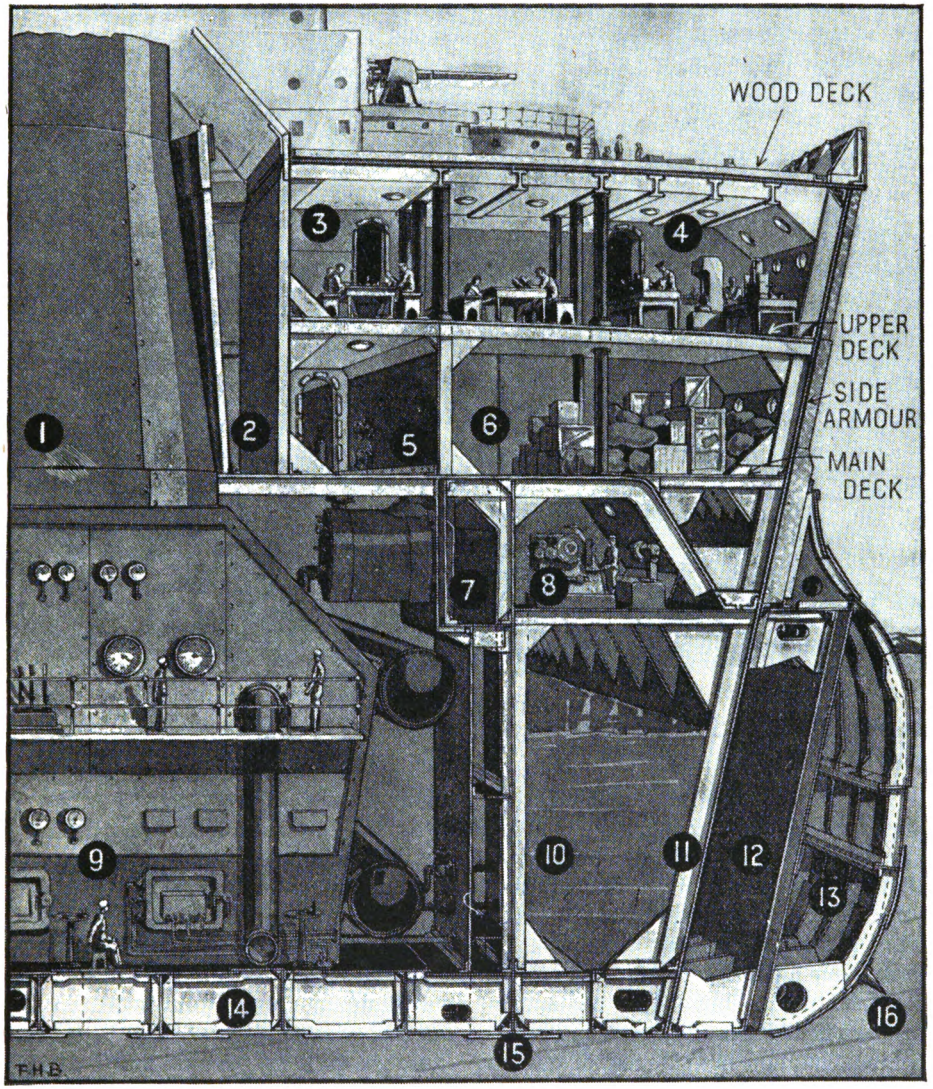

MIDSHIP SECTION OF POST-DREADNOUGHT CAPITAL SHIP

1, Funnel; 2, air space; 3 and 4, mess spaces and workshops; 5, passage; 6, store-rooms; 7, air lock; 8, auxiliary machinery space; 9, boiler-room; 10, oil fuel; 11, protective longitudinal bulkhead; 12, and 13 bulge compartments; 14, double bottom; 15, docking keel; 16, bilge keel

would constitute a serious danger to the stability of the ship. Naturally the engine-room officers do not welcome intensive subdivision and small compartments, but this is an essential matter where convenience should give place to safety.

Oil fuel has been a great boon as regards subdivision, being more easily disposed of in small compartments than coal could be. The watertight bunker doors, of which there were a considerable number, have therefore been eliminated.

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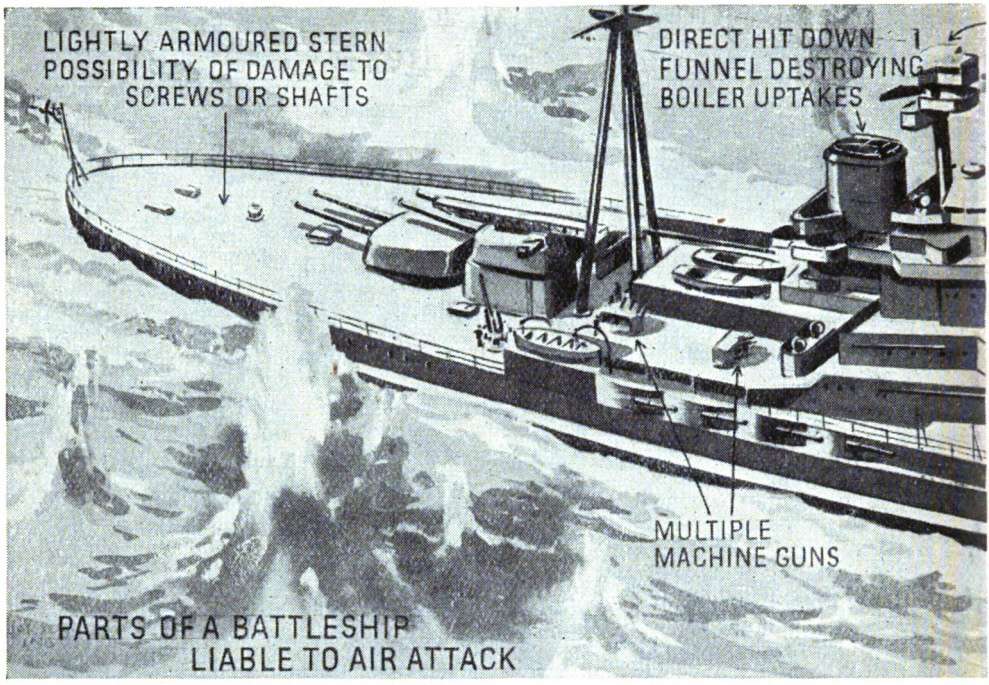

HOW A BATTLESHIP IS PROTECTED

Diagram showing parts of a battleship most vulnerable to attack from the air. The inset shows the general arrangement of side, deck and underwater armour over vital areas.

The introduction of electricity has helped to preserve the integrity of the watertight bulkheads. Before the advent of electric power it was necessary to bore a number of holes through the bulkheads for ventilating pipes, drain pipes, salt and fresh water pipes, voice pipes and suction pipes for the various bilges and watertight spaces. All this desecration of watertightness has now been corrected. Instead of drain pipes being led to the main pumps in the engine-room, powerful electric pumps are installed in each large compartment of the ship. Now the only holes in such bulkheads are those required for steam pipes for machinery purposes, and these are of recent years being reduced to a minimum.

The electrical equipment of a ship is on a vast scale; a hundred or more miles of cables and wires, large and small, traverse the ship in all directions. Large dynamos to provide for the ordinary electric light and power services, and also the powerful searchlights, are accommodated in separated rooms, whence they supply power on the grid system.

Since the original H.M.S. *Dreadnought* was designed great improvements in the internal arrangements of ships have been made possible by the extended use of electricity. Long leads of piping and shafting to the capstan and steering engines have been eliminated. Powerful emergency centrifugal pumps have been fitted to deal with large quantities of water in case of damage during action. Electricity has also been applied to the ammunition supply services, to the operation of twin medium gun turrets and to the manifold control systems. In this latter, great developments of telephones

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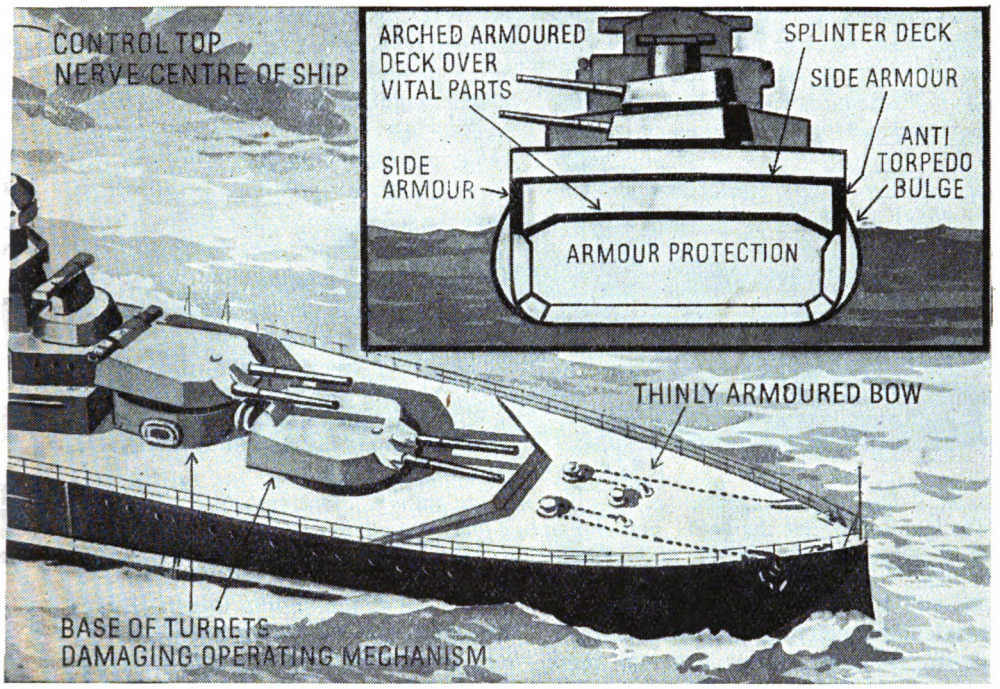

AGAINST ATTACK FROM THE AIR

Damage to the lightly armoured stern might render a ship immobile, so making her an easier target. The midships section, containing the funnels and control tower, is heavily armoured

and telegraphs with the necessary exchanges and other electrical systems have proved of the utmost value. Besides the wireless systems, the cinema, loudspeakers for transmitting news and orders to the ship's company, searchlights, navigation and signalling lights and the degaussing appliances are installed.

Electricity has also largely helped the Admiralty in their policy of promoting comfort and improving the hygiene of the ship's company; these have been well attended to in the design of all recent large ships in the British Navy.

Cabins or bunks cannot be provided for all the 1,200 or 1,600 persons on board, but every effort has been made to make the living accommodation for every one convenient and healthy, in accordance with the wishes of the men and the advice of the medical officers.

Provisions of all kinds are hoisted on board by electric winches and dispatched to their respective store places—beef, mutton, fish, poultry, etc., to the "cold" room, where 10 degrees Fahrenheit can be maintained—bacon, butter, eggs, fresh milk, etc., to the "cool" room where 25 degrees is maintained. Both rooms are artificially cooled by brine, carefully ventilated and well insulated. Cooled cupboards, maintained at 35 degrees, are also fitted on the mess decks. A very great contrast to the provisioning of forty years ago! Fresh vegetables and potatoes are passed to store places on the weather deck, which are well ventilated and easy of access, and are even provided with electric potato peelers.

Separate galleys and hot cupboards are provided for the captain (or admiral), ward-room, gun-room, and for warrant

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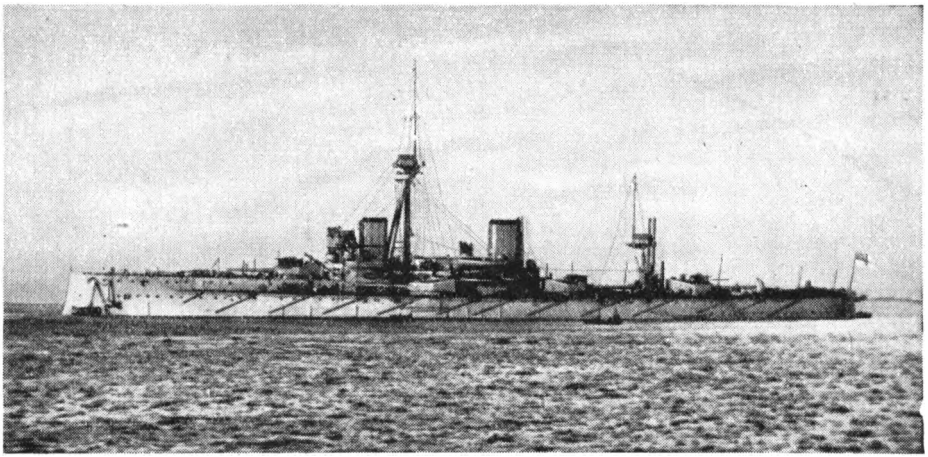

H.M.S. DREADNOUGHT

H.M.S. Dreadnought, launched in 1905, was the most powerful battleship afloat at that time. She was armed with ten 12-in. guns and twenty-four 12-pounders. She had a displacement of 17,900 tons. The launching of this famous ship began a new era in battleship construction

officers' messes. Enclosed messes are provided for petty officers, artificers, etc., according to rank; but food for these messes is provided from the general mess. In the "general mess" system all cooking, washing-up, etc., for the ship's company is centralized; but the men are grouped into separate messes with their own tables, forms, mess racks, bread lockers, clothes lockers, hammock racks, etc. Many of these lockers are made of light metal and present a gay appearance.

A large cooks' kitchen, fitted with electric mincers and other utensils for the preparation of food, is built near the galley house which has cooking ranges, boiling coppers and steam ovens which are oil-fired, the oil being sprayed by means of electric blowers which provide a very convenient method for regulation. Here also are hot cupboards, sinks, etc. In every large modern ship, excellent bread-making and bakery plants are provided.

After the food has been cooked it is passed down into a serving room by means of a lift. This room is fitted with the necessary tables, hot cupboards, crockery, etc., and from there the food is sent out to the various messes. A convenient scullery is fitted up nearby.

The men are provided with a reading-room, library, recreation-room, lecture-room and cinema outfit. Baths cannot be provided for all, but there are excellent wash places with hot and cold fresh water, salt water shower baths, etc. The stokers have dressing-rooms fitted with lockers for clean and also for dirty clothes. Drying-rooms are provided for general use. Stowage is also fitted for oilskins and overcoats.

The cooks' department is supplemented by wet and dry canteens, and by American soda fountains with ices.

The main portion of the extreme after part of the ship is devoted to the admiral's quarters. They usually comprise an after cabin, the counterpart of a reception- or drawing-room ashore; a dining cabin, which extends athwartships and which can accommodate some twenty or more guests, and two sleeping cabins. The second one is built in case it should be necessary, as is often the case, to put up an official guest, such as an ambassador or a military commander-in-chief.

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It should be appreciated that the admiral, and also a captain, if he happens to be the senior officer present in a harbour, has a considerable amount of official entertaining to do. A senior naval officer has not infrequently to assume diplomatic functions, when good entertainment is often a firm stepping-stone to an amicable settlement. He also has to entertain a considerable number of officers of his own ship and those on board other vessels of the fleet. Further, an admiral messes his personal staff, consisting of his flag captain, chief of the staff, flag lieutenant and secretary.

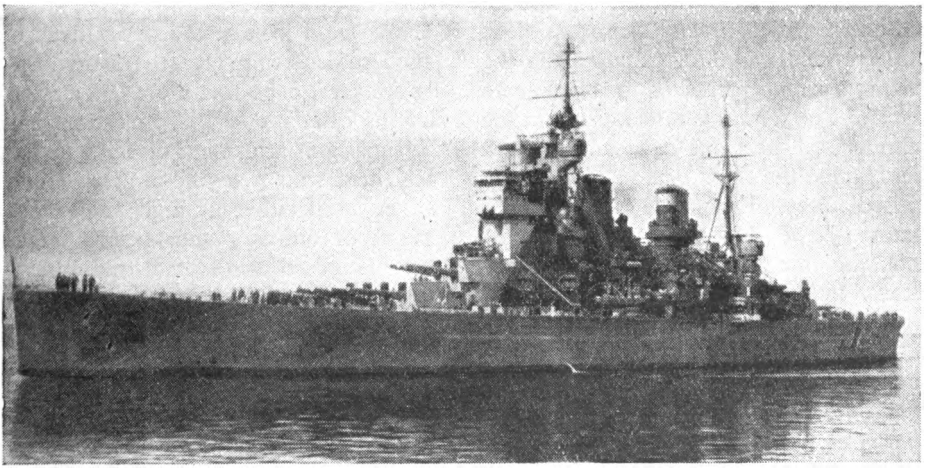
The next mess in importance is the ward-room, tenanted by the remainder of the officers of the rank of lieutenant and above in all the various branches of the Service—Royal Marines, engineers, paymaster and medical officer, as well as the chaplain and naval instructor and Air Service officers. These officers have cabins near the ward-room; one or more bathrooms are provided for ward-room officers.

Then we come to the gun-room. Here the junior officers live and have their being, and very crowded they are at times. Lockers are provided for the books and private belongings of the youths. Next we come to the warrant officers' mess, occupied by the gunners, boatswain, shipwright and all other officers of warrant rank.

All these messes are provided with cooking galleys, off-shoots of the main cooking establishment farther forward in the ship. Store rooms for grocery, provisions and wines are beneath the messes.

Working forward in the ship we come to the Marines' messes, with a screened mess for the sergeants. The men sit at tables but have convenient racks nearby for their private belongings, and also for their mess traps. Separately screened-off messes are likewise provided for the ship's petty officers.

It seems almost inconceivable that the comfort of the men could have increased to the extent that the last thirty years have witnessed. Forty years ago life on board was somewhat primitive. In most ships salt provisions were served out the day after leaving harbour. Fresh water was severely rationed. Each mess of fifteen to twenty men had one wooden



H.M.S. DUKE OF YORK

H.M.S. Duke of York, sister ship to H.M.S. King George V, represents the latest development of British naval design. She has almost twice the displacement of and far greater speed than her distinguished ancestor, shown opposite, though the basic design is similar

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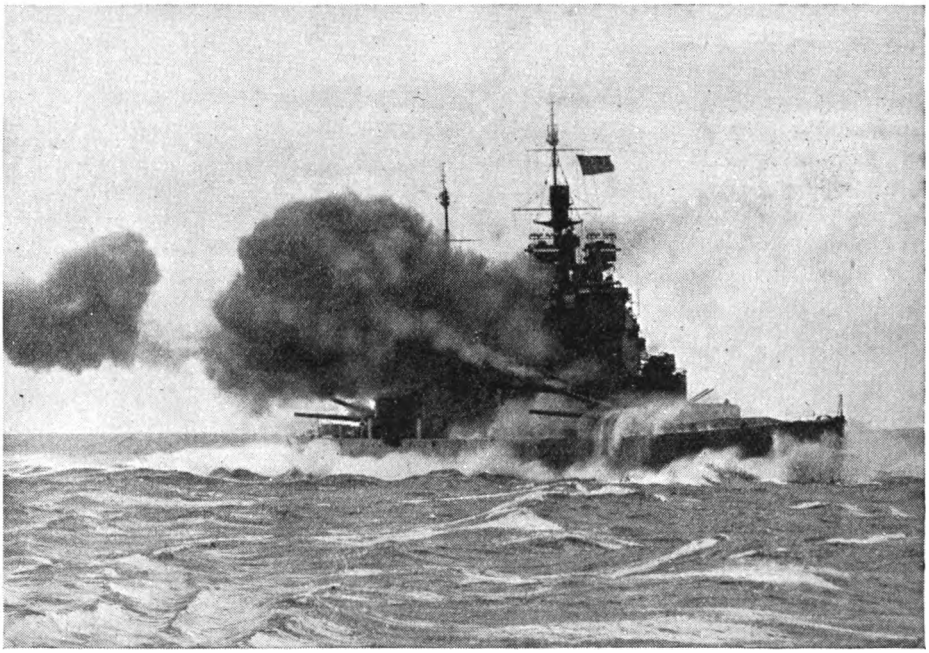

H.M.S. DUKE OF YORK FIRING A SALVO

H.M.S. Duke of York is a representative of Britain's modern capital ships. They are armed with ten 14-in. guns as a main armament. These guns, though of smaller calibre than those in earlier types of British capital ships (see pages 106 and 107), are in effect more powerful

tub for the men to wash in. Their messes were the only places where the men could sit down under cover. The mess deck was crowded, and the ventilation and the sanitary arrangements of an inadequate nature. The food was monotonous in the extreme: salt beef one day, salt pork and pea soup the next, and occasionally tinned meat of not too appetizing a nature. Ship's biscuit, hard as a rock, took the place of bread. The only approach to luxuries such as tinned salmon, preserves, cheese, or butter were obtainable from the canteen or from bumboatmen and then in distinctly limited quantities. There was no recognized stowage sufficient for the men's oilskins.

Now all this has been changed. The comfort of the men has received the constant care of the Admiralty, and the result has been shown in the improvements introduced in our recent men-of-war and enumerated in these pages.

Now for a look at the upper deck of a modern battleship. Here the distinguishing features to be found are the aircraft and the catapults for their ejection, and the small gun armament of eight turrets each fitted with two 5.25-in. guns. They can be used either as high angle anti-aircraft or ordinary anti-torpedo attack guns. There are also four or more multiple pom-poms for anti-aircraft work.

Forward on the weather deck are the electric windlasses for chain cable work. The cables are very heavy, the steel of each link being three and a quarter inches in diameter, and the weight sixty to seventy tons per length of twelve and a half fathoms. The anchors are of the "stockless" type and can be hove right up into the hawse pipe. This alone makes

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a great saving of time over the pre-dreadnought method of stowage. The ships can now proceed at fast speed the moment the anchor is above water, without waiting to "cat" and "fish" it as was necessary of old.

Above the upper deck rears the superstructure. This erection is necessary to provide stowage for the boats when at sea, to accommodate the electric boat hoist motors, to protect the bases of the funnels and stokehold and other ventilators. It is shaped to occupy as little of the breadth of the ship as possible so as not to reduce the extreme training of the heavy guns. At the fore end is placed the foremast for wireless aerial and signalling purposes. A second mast rises above the after end of the superstructure. Just before the foremast an impressive structure is built which contains the conning-towers, chart house, admiral's and captain's sea cabins, navigating platform and room for the spotters.

Modern battleships have so great a length that from the admiral's cabin to the navigating bridge may be over 150 yards and include quite a respectable climb. This route is too long for a man to traverse quickly in an emergency. In wartime, therefore, when at sea neither the captain nor the admiral leaves the bridge at night time, hence the absolute necessity for having cabins near at hand.

Every taxpayer must have noticed with concern how greatly the cost of our battleships has risen in the last forty years. H.M.S. *Dreadnought* cost £1,784,000, H.M.S. *King George V* roughly £10,000,000. How has this come about?

The tonnage of H.M.S. *King George V* has risen from H.M.S. *Dreadnought's* 17,900 to 35,000 tons. This rise can be partly accounted for by the fact that the speed of the larger ship has risen from the twenty-one knots of the smaller to over thirty-one knots. Also the larger ship has an armoured upper deck, whereas H.M.S. *Dreadnought* had not. The horse-power of H.M.S. *Dreadnought* was 23,000—an increase of nearly thirty per cent over the previous record for a battleship. H.M.S. *King George V* has risen to six times that of H.M.S. *Dreadnought*. To accommodate so great a horse-power, increased tonnage and length of ship were necessary. To armour this lengthened ship, again more tonnage was required. The side armour is also very much thicker. No wonder, then, that the increase in the cost has been so great.

If we take cost as a criterion, the following table speaks eloquently of these increases. The figures given are thousands of pounds sterling.

At all events one thing is certain—in a modern battleship the country is receiving full value for the money spent.

	Cost in Thousands of Pounds		Percentages	
Item	*Dreadnought*	*New ship*	*Dreadnought*	*New ship*
Armament, including gun shields	511	2,900	28.7	29.0
Armour, barbettes, sides and decks	482	3,000	27.0	30.0
Machinery	340	2,100	19.0	21.0
Hull and equipment	451	2,000	25.3	20.0

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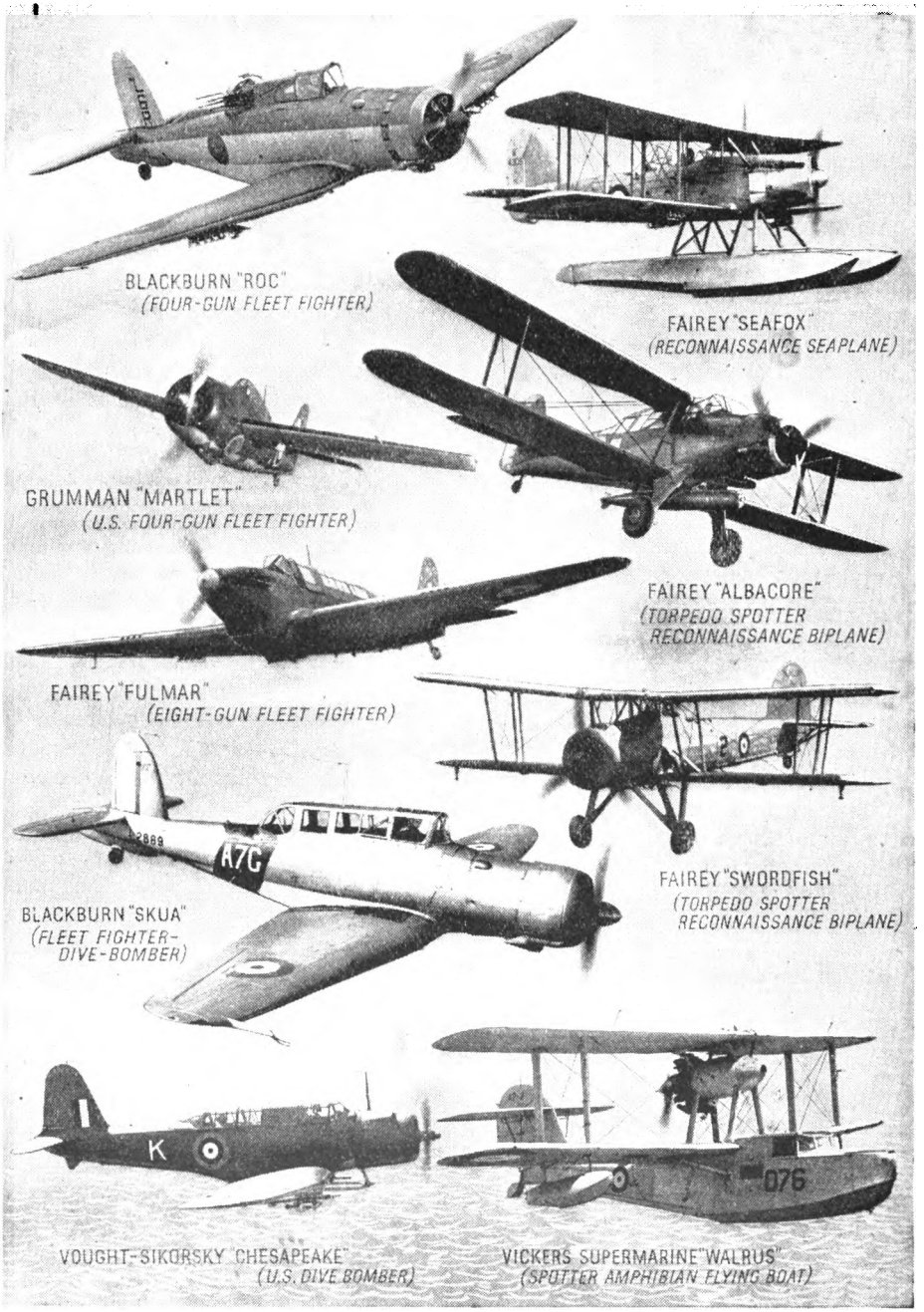

AIRCRAFT OF THE NAVAL AIR ARM

Torpedo, fighter and reconnaissance aircraft used by the Naval Air Arm. The Martlet fighter and the Chesapeake dive bomber are American designed and built. Ship-borne aircraft are somewhat slower than their land-based counterparts owing to the operational conditions

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CHAPTER 7

The Naval Air Arm—Yesterday and Today

Early days. Development of carriers. Principles of design. Types of aircraft. Bombs and torpedoes. Navigation. Duties of pilot, observer and air gunner. Maintenance. Vickers Walrus. Effect of aircraft on naval tactics. Reconnaissance and aerial attack. Fighter Protection

BEFORE the war of 1914-18 began, flying had been a pastime for fine weather and selected days. Seaplane flying had only been attempted from sheltered waters. Very little attention had been given to the many problems facing those who wished to design an aircraft capable of meeting even the slight surface movement of the North Sea in summer months. When these difficulties had been overcome, there were others. If the aircraft were to operate far out to sea, or even over Germany, they had to be carried part of the way in a ship which had to be designed to house them, hoist them out when they got to the point of their departure and then hoist them in again when they returned from their flight. These problems were solved so promptly that the Royal Naval Air Service was able to carry out its first raid on German territory on Christmas Day, 1914. The seaplane sheds at Cuxhaven were bombed by naval seaplanes flown from three seaplane tenders, which had carried them more than halfway across the North Sea.

Until the summer of 1917, seaplanes and airships continued to be the only types of aircraft which could operate far from land in support of ships at sea. At the Battle of Jutland an aircraft on reconnaissance located the German High Seas Fleet, but failed to report this owing to a wireless defect.

The operation of seaplanes in open waters soon showed that flying would be very dependent on the weather. An alternative to seaplanes therefore became a necessity if the Navy was to reap the benefits offered to a fleet by aviation.

FIGHTER PROTECTION OF SHIPS

Experiments in flying aeroplanes off ships soon proved successful. In 1917 a small fighter flown from a cruiser, H.M.S. *Yarmouth*, succeeded in shooting down a Zeppelin which was proving troublesome to our squadron. This was the first instance of successful fighter protection of ships by their own aircraft.

Although small fighter aircraft could now take off from a ship, they still had to land on the sea, when the aircraft was usually lost but the pilot was frequently rescued. This could not be regarded as a wholly satisfactory solution of the problem and trials to determine how aircraft could be made both to land on and to take off from ships were pushed ahead with vigour. They soon proved that, though this was a hazardous undertaking, it was by no means an impossibility.

At this time the armament of H.M.S. *Furious*, a cruiser with a displacement

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of about 20,000 tons and a speed of some thirty-two knots, opportunely came under review. Instead, however, of modifying the armament, it was decided to convert her into an aircraft carrier. Two things were essential to allow the aircraft to land safely; these were a sufficiently long flight deck on which they could lose their forward motion, and the ship's upperworks to be so designed as not to cause severe eddies and air currents to interfere with the handling of aircraft immediately before and after they had landed. Several attempts were made to find a suitable design and eventually the long, flush flight deck was evolved. All the upperworks were removed, the captain's bridge was tucked away in the forward part of the ship and the smoke from the boilers was led away aft in long trunks, where it was mixed with cold air before it was allowed to escape. Needless to say, the new appearance of the *Furious* was somewhat startling to the orthodox sailor of those days, who probably did not "hold much with aeroplanes." Aircraft carriers had, nevertheless, come to stay.

ISLAND CARRIERS

The conversion of another ship to the role of aircraft carrier was before long put in hand; and, in due course, the Italian liner *Conte Rosso* appeared as H.M.S. *Argus*. She also was flush decked but, later, the difficulty of disposing of a ship's smoke except through funnels of a fairly orthodox design drove the designers to attempt an island carrier. This is one in which the funnels and some of the superstructure are built up above the flight deck, well out to starboard or port of the centreline. Aircraft taking off, or landing, have enough room to pass this superstructure without hindrance. This new type of carrier was introduced into the British Navy in H.M.S. *Hermes*, the first ship to be designed and built as a British aircraft carrier. Trials soon showed that the island interfered less than was expected with flying, and did away with the need for the long smoke ducts which took up so much room in the hangars. Accordingly, H.M.S. *Eagle*, once the Chilean battleship *Almirante Cochrane*, was soon converted to this type. More carriers were, however, still needed. The cruisers H.M.S. *Courageous* and H.M.S. *Glorious*, both built to the same dimensions as H.M.S. *Furious* but mounting four 15-in. guns, had been in action with units of the German Fleet on November 17, 1917. In the scaled-down navy after the Washington Treaty, they were earmarked for conversion. Thus three ships had been converted to carriers of island type by the year 1930.

REQUIREMENTS IN DESIGN

For some years after 1930 the Admiralty did not increase the number of carriers but their design was continually under review. High speed was an essential to enable the carrier to operate with the fleet. This meant that a large proportion of the available space had to be given up to high-powered boilers and engines. The ship had also to be very manœuvrable and able to turn rapidly, as flying operations require a carrier to be turned into the wind whenever aircraft were flown on or off. To operate for long periods at sea she had to carry a large quantity of oil fuel for herself and petrol for her aircraft. The petrol had to be carefully protected in order to reduce the risk of fire, and arrangements to extinguish fires in the hangar had to be on a generous scale. An armament to give maximum protection against air attack had also to be worked into the design without interfering with the flying arrangements. Allowances had, in addition, to be made for workshops to enable damaged aircraft to be repaired while the ship was at sea, and for store-rooms for the enormous number of different spares required by

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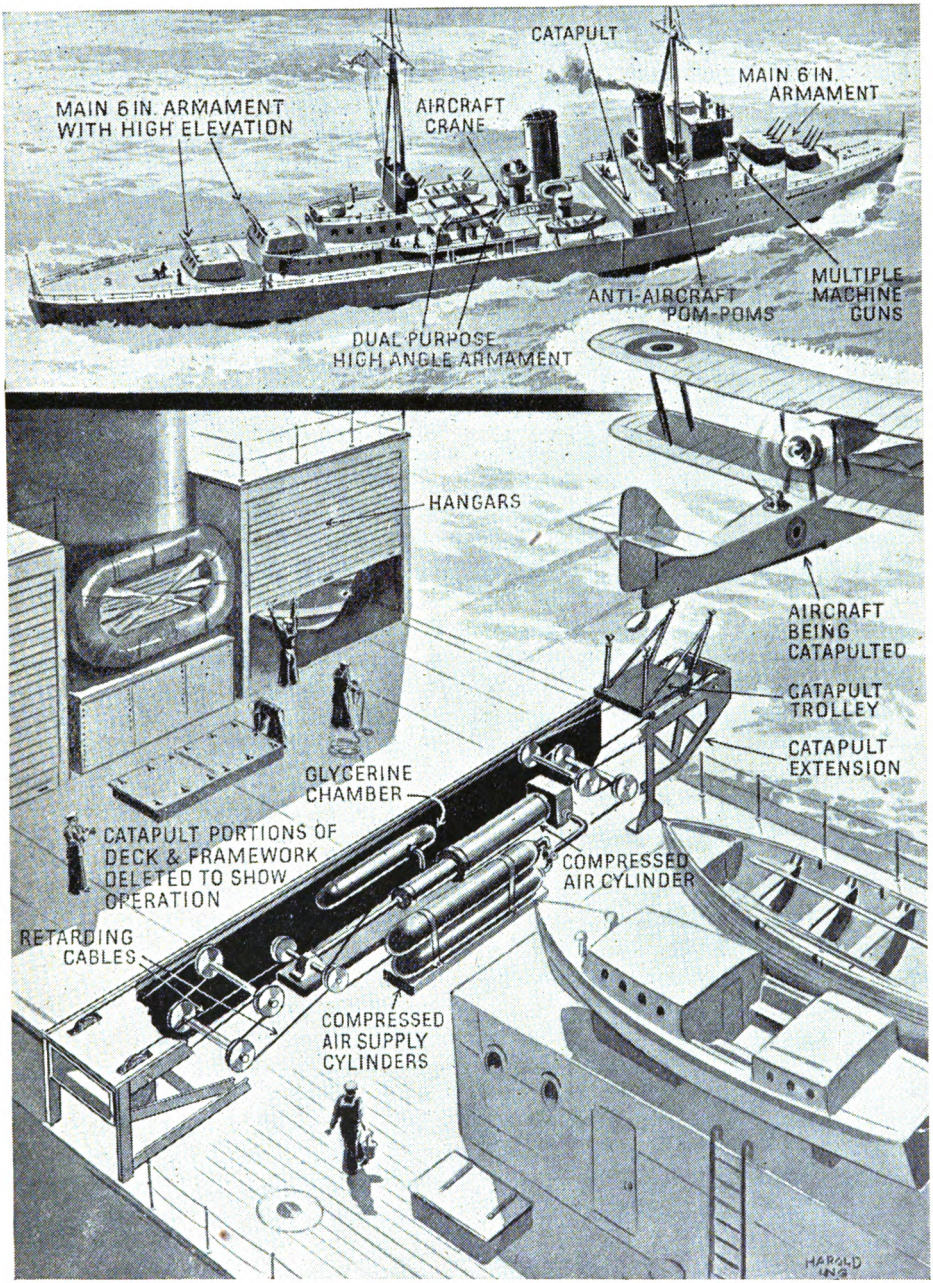

CATAPULTING AN AIRCRAFT FROM A CRUISER

Above is seen the position of the catapulting apparatus in relation to the ship's armament. Below, the compressed air mechanism and extended catapult trolley is shown. The retarding gear holds the trolley back while the aircraft continues forward to become rapidly airborne

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modern aircraft, from spare propeller blades to tail wheels. Accommodation for the air crews and maintenance ratings had to be carefully thought out; and, in addition to all these, the normal provision of space for the ship's crew and stowage for everything from motor-boats to beef and potatoes had to be included. The major requirement, of course, was that the ship should be able to carry enough aircraft to make her in all circumstances a worthwhile unit of the fleet.

By 1935 the world political situation had deteriorated so badly that rearmament became once more the accepted Government policy, and it was decided to strengthen the British carrier squadron by the addition of another new ship. The latest designs were reviewed and approved, and H.M.S. *Ark Royal*, the third ship of her name, was ordered in April of that year. Three years were taken to build her and she joined the Home Fleet in place of H.M.S. *Courageous* in the autumn of 1938, over three million pounds having been spent on her construction.

H.M.S. ARK ROYAL

But the money was well spent. H.M.S. *Ark Royal* was able to accommodate nearly sixty aircraft in two vast hangars, one above the other, extending almost the whole length of the hull. Three lifts connected these with each other and with the flight deck. Engines and boilers of the latest design gave her a speed of well over thirty knots, so that only the fastest destroyers could keep up with her. A first-class anti-aircraft armament of sixteen 4.5-in. guns and six eight-barrelled pom-poms with many smaller guns was fitted into her vast hull. She carried enough petrol to keep her aircraft flying while she herself could remain at sea, and her oil fuel capacity exceeded that of any ship ever built for the Royal Navy. A complement of 1,500 men was accommodated in large and comfortable mess decks, and she was accepted as a very satisfactory type of carrier.

Before H.M.S. *Ark Royal* came into service, however, the increasing age of the old carriers and the growing threat of war made more additions to the carrier strength an urgent necessity. A further class of four was therefore ordered in the Navy Estimates of 1936 and 1937.

FORMATION OF R.A.F.

The type of aircraft most used by the Navy changed from the seaplane to the wheeled land plane as the need of launching aircraft from the deck necessitated wheels to replace the floats.

At the time that the aircraft carrier had become an accepted fact, the Royal Air Force was formed by combining the R.N.A.S., now numbering 55,000 officers and men, with the Royal Flying Corps. Thus the Admiralty became no longer in control of the design and production of its own aircraft. From the earliest days of aircraft carriers until the middle of the Second World War, the aircraft of the Naval Air Arm have been primarily land planes modified to suit ship-borne needs. Advance in design has been slow. While Britain entered the Second World War with the planes of the R.A.F. second to none in quality, the same could not be said of the aircraft at the service of the Admiralty in the Naval Air Arm. When aircraft first started landing on aircraft carriers, in 1917, there was little difference between the land and the naval aircraft. After twenty-three years of progress the speed of the naval bombing aircraft had increased from about seventy to one hundred miles an hour, while that of the contemporary aircraft of the R.A.F. well exceeded the two hundred mark. Similarly with fighters, the Navy entered the war with a fighter whose top speed was less than two hundred miles an hour while the performance of Hurricanes and Spitfires surprised the German pilots.

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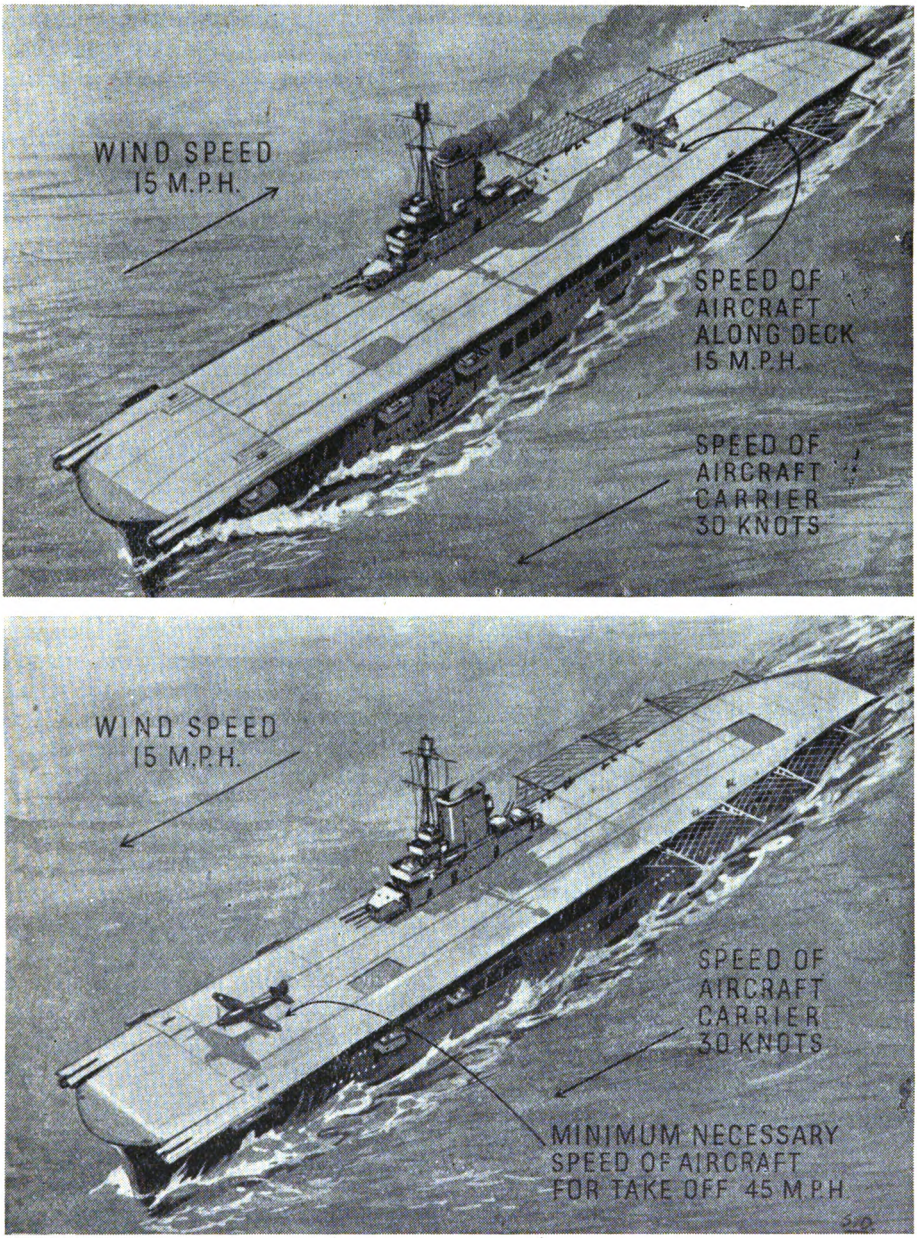

TAKING OFF FROM AN AIRCRAFT CARRIER

The speed of the carrier and the strength of the wind both affect the take-off. Let us assume that the plane must achieve an approximate speed of 60 m.p.h. before becoming airborne. In the top drawing the wind and the speed of the carrier together give the plane a speed of 45 m.p.h. To become airborne an extra speed of 15 m.p.h. only is needed. Below, the carrier's speed of 30 m.p.h. is reduced by a following wind and the speed necessary becomes 45 m.p.h.

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However, speed is not everything, and considerable progress had been made in many other directions. Let us consider briefly the requirements of a naval aircraft. First of all, it must be of such a size and design that it can land on and take off from the restricted space of a flight deck; unless it can do so, it is useless. It must be designed to fly safely at slow speeds, and made to stow compactly so that as many planes as possible can be carried in one ship. This means folding wings, even in the case of eight-gun fighters with all their complicated gun controls and power leads. Another highly important point is that, as far as possible, the number of types of aircraft in a carrier must be kept as low as possible. Stores have to be carried for each type of aircraft in the ship and the space available for them is very limited. Aircraft landing on a carrier are arrested by deck wires which entails special design to meet the stresses induced by the drag on the fuselage. When catapulted off from a battleship or cruiser with a full bomb or torpedo load, they must stand up to the acute shock which would disintegrate many an aircraft designed for use only from aerodromes. They must be simple to repair and easy to maintain, for all their repair work is done in a crowded hangar where there is only just room for mechanics to walk between the marshalled aircraft.

TYPES OF AIRCRAFT

The first aircraft to be stowed in H.M.S. *Furious's* hangar met none of these requirements but it was not long before improvements were introduced into succeeding types. Up to 1935, however, there were still three main types in service, the single-seater fighter, the single- or two-seater torpedo-carrying bomber, and the three-seater spotter reconnaissance aircraft. The necessity for carrying each class of aircraft meant that even our largest carriers of the *Glorious* class could not carry more than twenty-four torpedo bombers since at least twelve single-seater fighters and a further twelve reconnaissance aircraft were needed. This made for too much rigidity. When search was the order of the day, only twelve of the aircraft could undertake it; and after they had found the enemy, these were not able to take part in the general attack with the striking force of torpedo aircraft. In 1935 the Naval Air Arm made a big stride forward when the Shark aircraft started their service afloat, followed a few months later by a similar type, the Swordfish.

SWORDFISH AND SHARK

Both these types of aircraft were able to combine the duties of reconnaissance and attack. They could carry a torpedo or go on a long reconnaissance flight over the sea with a crew of three in search of their peace time "enemies." They were in a sense rivals, too, for it was intended that only one should survive for regular operational service with the fleet. There was very little to choose between the aircraft, but the Swordfish was selected and took its place as the standard Torpedo Spotter Reconnaissance aircraft of the N.A.A. in 1937. The Shark was relegated to training duties. These were the first "maids of all work" to belong to the Naval Air Arm. Whether for searching or spotting, attacking the enemy's ships or land targets, or even for taking the ship's mail ashore, the Swordfish was always in demand. What was more important, there were now thirty-six aircraft available in the large carriers for either search or attack. Should the enemy be evasive, search could be carried on indefinitely and, when he was found, an overwhelming attacking force could be sent to bomb him or strike him under water with torpedoes.

The Swordfish has really been a remarkable aircraft and is the most redoubtable biplane in any combatant air service. When seen among other modern

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aircraft it looks rather old-fashioned, but its record in war is unsurpassed by that of any other type. Swordfish squadrons were responsible for crippling the Italian fleet at Taranto, for preventing the *Bismarck* escaping into Brest, and for ravaging, from their Malta lair, Mussolini's supply lines to his North African colonies. Its speed is low; its operational best is about ninety-five miles an hour, though, when light, it can pass the hundred mark. Its manœuvrability is good which is important as its principal method of defence against fighters is to fly slowly close to the water doing sharp turns so that the swift fighters cannot keep behind it or get into position to carry out their attacks. These tactics have saved the life of many a Swordfish crew when they were set on by land-based fighters. It is a good weight carrier, too, for it can carry comfortably half as much again as a Blenheim bomber, even when taking a crew of three and a full load of petrol. Its alternative loads are generally an eighteen-inch naval torpedo, weighing about 1,500 lb., for use against ship targets, or six 250-lb. bombs for bombing targets ashore.

"STRINGBAGS"

Owing to their rather low speed, Swordfish are the most efficient dive bombers in the British air services, but they must be well protected by fighters if they are to reach their targets in the face of even slight air opposition. Swordfish squadrons were used with effect against the advancing German armies in Northern France in 1940; and, again, in the first two campaigns in Libya where they were used extensively in co-operation with the Army. The swift success of the operations in Madagascar was very largely due to the incessant bombing of the opposing troops by Swordfish, flying under the protection of naval fighters. Tripoli has been dive-bombed by Swordfish; and even the people of Leghorn, well away from the usual run of the British aircraft carriers, have been awakened by the explosions of bombs and listened to the sound of these aircraft returning to their ships at a modest ninety knots. Except for their lack of speed they are popular in the N.A.A., where they are known affectionately if disrespectfully as "Stringbags."

NAVAL FIGHTER AIRCRAFT

The advance in design of the fighter has been rapid since the war began. While the Swordfish and their very similar brothers, the Albacores, could always be relied on to "fix" things somehow (even at eight thousand feet and ninety miles an hour), the first few encounters with enemy shore-based fighters soon gave convincing evidence that N.A.A. Fighter Squadrons had either to be equipped with something better, or else had best keep out of range of the shore-based fighters. The Skuas, a type of fighter dive bomber, were the aircraft called upon to meet Messerschmitt 109s and 110s, whose manœuvrability and gun power were at least comparable to those of the Skua and whose speed exceeded theirs by over a hundred miles an hour. Though hopelessly outclassed, the Skua crews did remarkably well, more than holding their own as fighters against the Germans during the brief Norwegian campaign and, by their dive bombing, sinking the German cruiser *Königsberg* as she lay alongside at Bergen. After a year of war they were replaced generally in the Navy by the Fairey Fulmar type, made by the firm which had turned out the Swordfish and Albacores. The Fulmars were a great advance on the Skuas since they were designed solely as fighters; with a good power of manœuvre, eight .303 machine guns and a considerably higher speed than the Skua, they startled the Italian bombers when they arrived in the Mediterranean towards the end of 1940. For many months they kept the skies near the British

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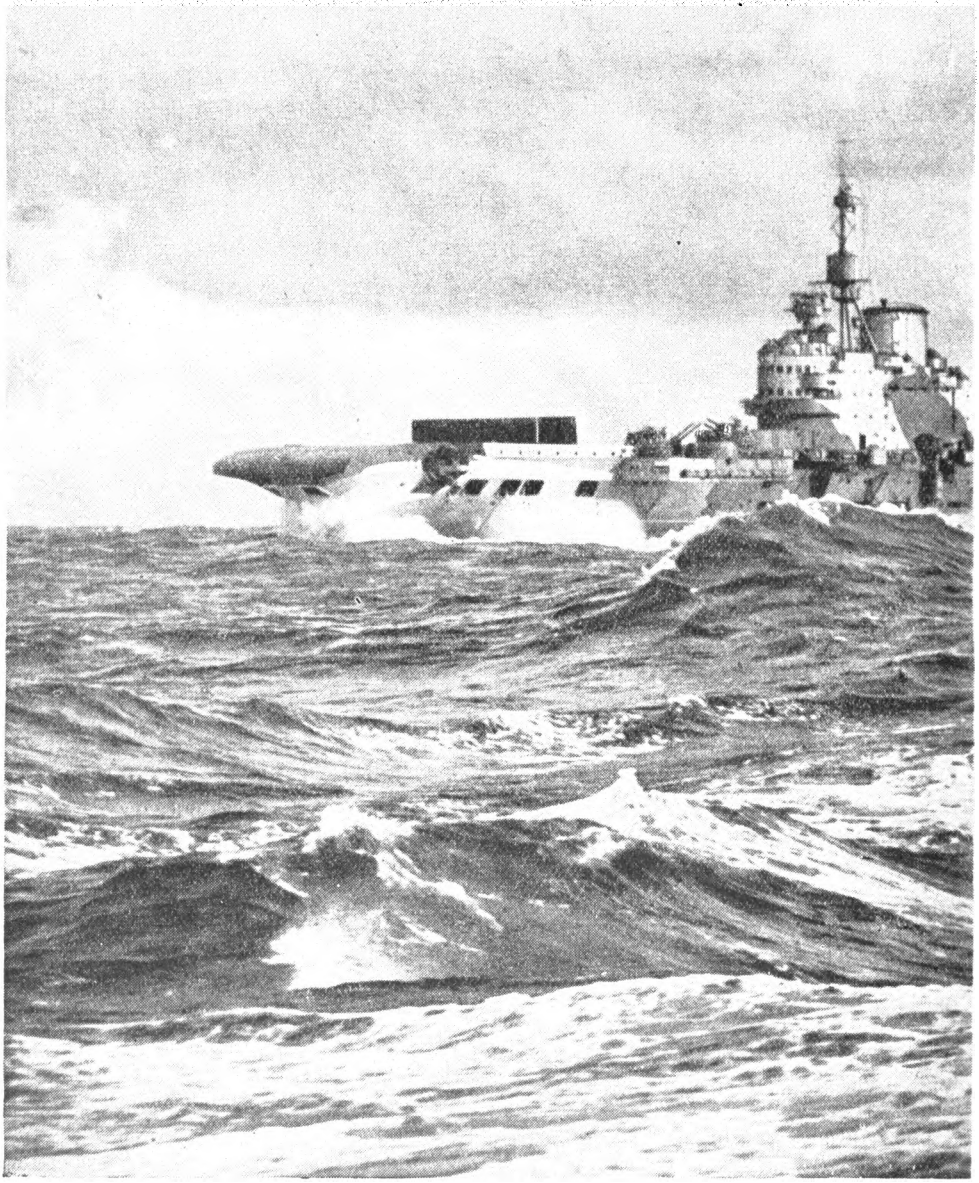

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H.M.S. Victorious, one of Britain's newest aircraft carriers, is a ship of 23,000 tons. Armed with sixteen 4·5-in. A.A. guns, her speed exceeds thirty knots

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convoys clear of the enemy but, when the Germans extended their conquests as far south as Crete and occupied Sicily and North Africa, the Fulmars found themselves surpassed by the improved shore-based fighters. There was little hope of the British aircraft factories being able to produce a fighter to meet the needs of the Navy except after very many months' work. Need would not allow such a delay, so, when reports came from our friends in America of an excellent new fleet fighter, it was decided to obtain some of these for trial in the N.A.A. They more than came up to expectations and an order was placed for a number of "F4Fs", known to us as the Grumman Martlet. It will be on this fine modern fighter, working in support of the older Swordfish and Albacore biplanes, that the Navy must depend to turn the tables on Japan when the time comes to drive her from her conquests in Malaya and the Indies.

EARLY MISSILES

In the very early days of aviation the idea of dropping things on to possible enemies on the ground occurred to many people. If the object dropped could be made to explode with a satisfying crash and a cloud of dust and smoke, so much the better for the man in the air and the worse for his unhappy earthbound opponent. The war of 1914-18 saw the introduction of two simple missiles—the steel darts, and the first types of bomb. The steel darts gave way to machine gun bullets and the experts soon tackled the job of improving the bombs. Both these types of weapon were effective against troops in trenches or on the march, but it was clear that they were no use against armoured ships. For one thing, armoured ships, even in 1914, could stand a great deal of heavy punishment. A shell weighing two thousand pounds did not inflict mortal damage to a battleship and bombs over the hundredweight mark were still few and far between. Until a weapon could be produced which would inflict serious damage on an enemy ship, the role of the naval aircraft was bound to be confined to reconnaissance and spotting.

It was at this stage of the war that consideration was given to the use of torpedoes from aircraft. Before success was achieved a number of difficulties had to be overcome. Torpedoes are heavy weapons and the standard naval model could not be carried by the aircraft of those days. Experiments were put in hand with small torpedoes to be carried by a specially designed single-seater aircraft with a light fuel load. The results were very promising and led to a small torpedo being dropped from a seaplane, operating from the *Ben-my-Chree*, against a Turkish transport during the Dardanelles campaign. It scored a hit and the ship sank; the so-called "aerial torpedo" had arrived with a bang.

Development of the new weapon was slow and no further successes with the airborne torpedo were achieved during the war of 1914-18. The improvement of torpedo tactics was left largely to the Naval Air Squadrons, and the R.A.F. entered the Second World War with very few aircraft capable of hitting ships in their vulnerable spots. It is interesting to note that the German Luftwaffe were in an even worse position, not having the equivalent of our N.A.A. squadrons, which were soon equipped with an efficient though small torpedo, carrying a deadly warhead of the latest design.

TORPEDO EXPLOITS

The success of these small torpedoes has been remarkable, in spite of the fact that they have to be maintained in the carriers by a hard-worked staff of torpedo ratings who deal with more torpedoes than were required to equip a whole flotilla of destroyers in the war of 1914-18. Their most spectacular success

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was the stopping of the *Bismarck* and the forcing of her to await destruction by the two most powerful ships of the Home Fleet. They almost succeeded in bringing to a stop the Italian *Littorio* class battleship at Matapan and did succeed in stopping the cruiser *Pola* which, with its two consorts *Zara* and *Fiume*, were sunk by our battleships later in the action. Such torpedoes were also mainly responsible for the damage at Taranto, though bombs were added to confuse the Italian crews. The greatest triumph of the torpedo, however, was seen in the operation of the Naval Swordfish squadron based at Malta. For vital weeks every Italian convoy loaded with essential supplies for the hard-pressed Axis army in Libya had severe toll taken of it.

BOMBS AND TORPEDOES

Development of the other aircraft weapons during the peaceful years was undertaken by the Air Ministry and the full benefit of their knowledge was placed at the disposal of the Admiralty when the Navy at last took over its air arm again in 1939. Bombs for every occasion had been designed and lay in the bomb rooms of the carriers; bombs with high fragmentation to shatter troops on the ground, bombs in tough steel cases to penetrate the decks of ships before they exploded, bombs in extra light cases and with a greater percentage of explosive than ever before for use against submarines. Plans for minelaying from aircraft were also held in readiness for use if needed.

Here it is appropriate to compare the methods of attack by torpedoes and by bombs. The bomb, if it is dropped from a great height, is falling almost vertically by the time it reaches the deck of a ship. Upon its weight and the height from which it has dropped depends its penetrative power, and the infinitesimal delay in the fuse determines where it will explode. This delay can be days long or it may be a matter of hundredths of a second; any variation can be arranged. The usual one is a tenth of a second (when the bomb is used against ships), for this is sufficient to ensure it exploding well down inside the ship where it will do most damage and may cause serious leaking as well as fires. The torpedo, on the other hand, drops into the water within a second or so of its leaving the aircraft and runs its journey towards the ship below the surface. It has to be dropped carefully from an aircraft flying not too fast and not more then two or three hundred feet above the surface of the sea. A selected depth is set on the torpedo before the aircraft leaves its base but this can be altered in the air if necessary. The lower you can hit a ship the more damage will be done to it and its propellers, so the running depth is always kept as deep as possible. The torpedo takes up its proper depth after one or two dives caused by the shock received by its machinery on its striking the water at a hundred miles an hour. Thereafter it runs on its course and at a steady depth in the same way as a torpedo fired from a submarine or surface ship. When it hits its target the explosive in its head is detonated outside and in contact with the hull of the ship. The force of the explosion and the incompressibility of water cause a terrific momentary pressure on the ship and water pours in through the gaps made in the distorted plates.

DIFFERING TACTICS

The tactics also of the bomber and of the torpedo dropper are quite different. The bomber must approach its target at a fairly steady height, course and speed so that the bomb aimer can make accurate adjustments to his bomb sight and ensure a hit. From a bomber flying at 240 miles an hour at 15,000 feet, the bomb is released when the aircraft is still a very considerable distance from the

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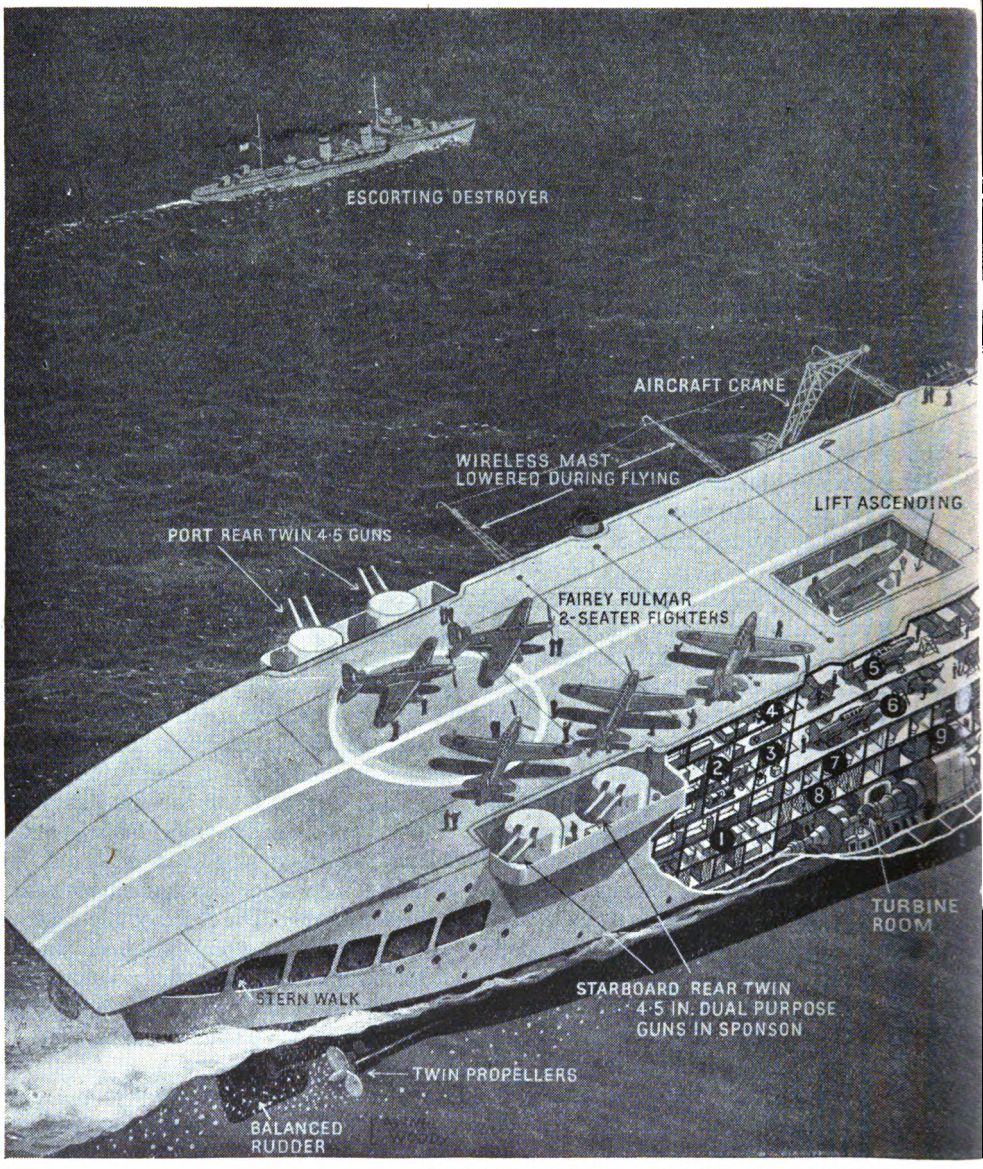

DIAGRAMMATIC DRAWING OF A MODERN

This Illustrious class carrier has a length of 735 feet, a speed of thirty knots and a displacement of 23,000 tons. The crew and flying personnel number 1,600 men. These carriers have seven decks—A, *Flight deck;* B, *upper gallery deck;* C, *upper hangar deck;* D, *lower gallery deck;* E, *lower hangar deck;* F, *upper deck;* G, *main deck. The numbers show:*

target. Accuracy in aiming is therefore an absolute essential if a hit is to be obtained with even a stick of bombs. The torpedo dropper, weaving about to avoid long range fire, will, on the other hand, probably approach the target at about ten

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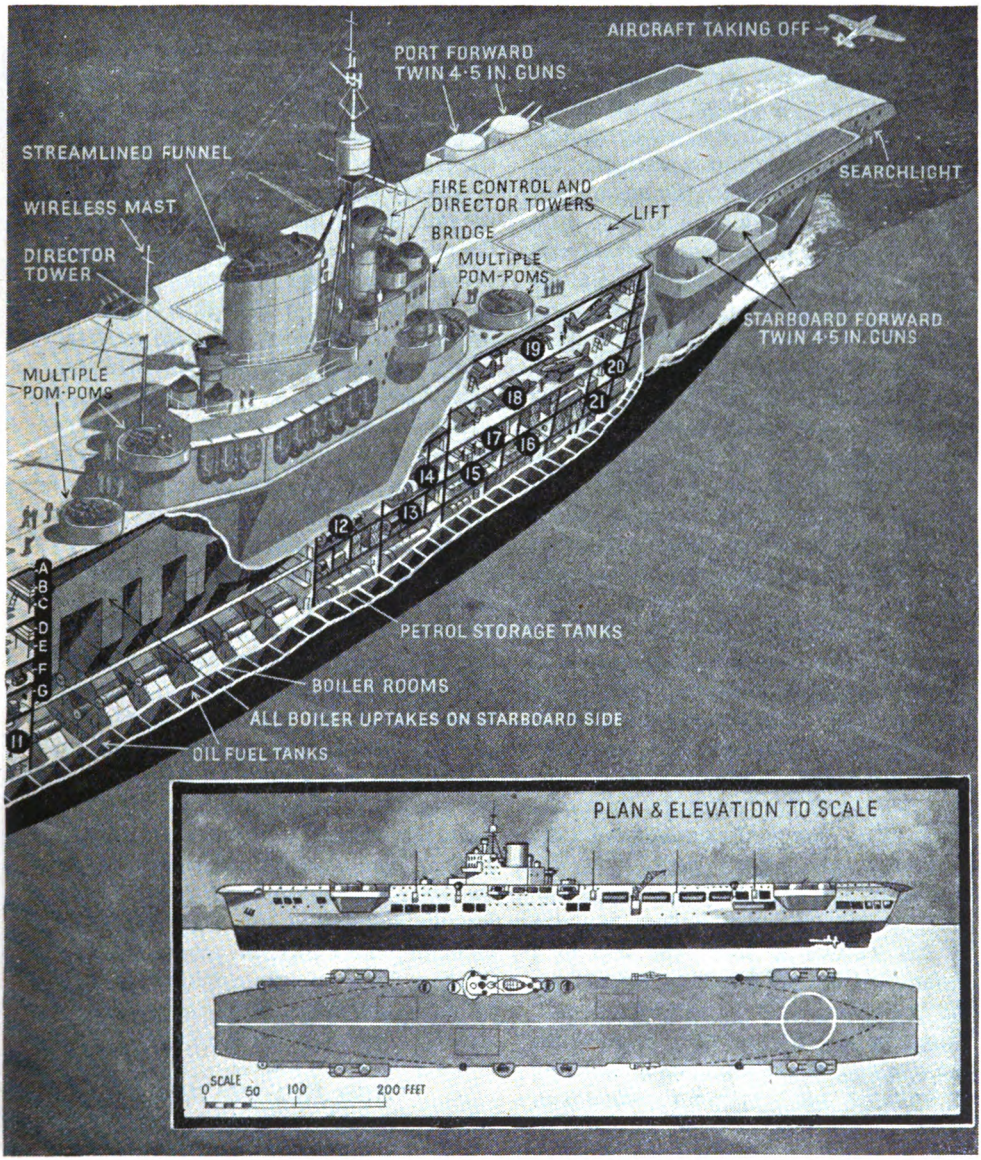

BRITISH AIRCRAFT CARRIER

1, Stores; 2, officers' cabins; 3, engineers' office; 4, repair shop; 5, upper hangar; 6, lower hangar; 7, baths; 8, stores; 9, fans; 10, workshops; 11, control platform; 12, fans; 13 and 14, auxiliary machinery; 15, mechanics' wash-place; 16, petty officers' wash-place; 17, seamen's mess; 18, lower hangar; 19, upper hangar; 20, butcher's shop; 21, stores

thousand feet. When within three or four miles of its objective, it starts a dive towards the surface, swerving and turning on the way down to confuse the ship as to its intentions. As it nears the surface, about 1,500 to 2,000 yards from the ship,

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it flattens out and loses speed rapidly. The pilot then brings his sights on to his target. He steadies the aircraft on his aiming course for a second or so, and then drops his torpedo when he estimates that the range from the target is not more than a thousand yards. So far, he has himself presented the enemy with a most difficult shot, but, during the few seconds before and the minutes after he has dropped his torpedo, he is in great danger if the enemy is well armed and has well-trained gun crews. If the aircraft is a Swordfish, the pilot will turn round and fly back the way he has come; but if it is a Beaufort, or similar type, he will scarcely be able to turn in such a short space, and must fly close ahead or astern of the ship. In either case, he presents an easy shot to the enemy's light gunners.

NAVIGATION PROBLEMS

Before any weapons can be used against an enemy, however, that enemy must be found. The range of the N.A.A. aircraft has increased the searching power of a fleet enormously. When the war of 1914-18 broke out the limit of a ship's vision was the horizon seen by the lookout in the crow's nest. Now the captain of any large cruiser or battleship or, of course, an aircraft carrier, can send off his aircraft to scour the seas to a distance of several hundred miles from the parent ship. It is a tiresome task, sitting in a draughty open cockpit for three or four hours with rarely anything in sight on the seemingly endless sea.

Navigation from a ship requires far more care and skill than navigation from land bases. The crew leaving an aerodrome for a flight over the ocean have only to reach the coast again to be able to make a landing somewhere. They can obtain wireless bearings from their bases at will and have a vast organization to assist them. The navigator working from an aircraft carrier or cruiser, on the other hand, is faced with a different problem. He never returns to the same position over the sea, because the ship, too, is always on the move and he must forecast accurately where she will be at the time that he expects to sight her. If he passes her in bad visibility there is nothing to tell him so. He will still see the same view and it may surprise many people to know that it is often harder for an aircraft to see a ship than a ship an aircraft. Visibility from the air over the North Atlantic averages less than ten miles throughout the year. If the naval aircraft navigator gets lost, he may ask his ship for a wireless bearing and, sometimes, he will get a reply. Sometimes, however, it is inadvisable for the carrier to break wireless silence and so give away her position and the navigator must shift for himself. The principles of accurate aerial navigation have been founded on a quarter of a century's experience; the secret of the safe and regular return to the carrier at the appointed time lies in careful attention to detail. Compasses must be corrected by observation at regular intervals, to check the errors caused by the magnetism of the aircraft. The air speed indicator must be checked so that its errors may be allowed for, the pilot must accustom himself to accurate and effortless course steering for four hours or more without a rest, and, most important of all, close attention must be paid to the weather.

WIND AND WEATHER

The weather has always had a great effect on aviation. In the early days, and even in peace time, aircraft did not fly if the signs were unpropitious; but war brooks no delay in the conduct of important operations. The aircraft must fly and they must be told what weather they can expect on their path. All aircraft carriers have an officer whose duty it is to study the weather reports broadcast at

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regular intervals by Allied shore stations. On these reports he will make a forecast of the local weather and this will tell the aircraft's crews what winds to expect on their flight and give other details which may be of vital importance. This information will be supplemented by observations during the flight and these will in turn assist the meteorological officer on the carrier in preparing his next forecast. The effect of wind on an aircraft is similar to the effect of tide on a ship. All naval observers are taught that they must check its direction and velocity at regular intervals if the plane is to be away from the carrier for any length of time. This is done by a slightly complicated manœuvre in the air, calling for accurate flying on the part of the pilot and careful work by the observer.

DUTIES OF A PILOT

The need for accurate course steering by the pilot has just been referred to; he has, however, many other duties. He must, while he is steering his course, be able to keep a good look-out for any ships or other aircraft, concentrating particularly on that part of the sea and sky which lies ahead. He must be proficient in the art of ship recognition for, in the fleeting glimpses obtained between the clouds, he must be able to tell friend from enemy. In spite of the limited practice he will obtain while serving in a carrier, he must be accurate to within a few yards when dropping depth charges or when dive bombing, for there is seldom the chance of a second attempt. Before he drops his torpedo by day or by night, he must judge the ship's speed to within a few knots and, in sighting, make due allowance for its movement until the torpedo is dropped. In an Albacore and Swordfish his only link with the other two members of his crew is a short length of rubber tubing through which the curt conversation of the air is passed. If things go wrong and, for example, there is no carrier where a carrier ought to be, he must not lose his head or his temper but do as the muffled voice coming up the pipe tells him; he must have implicit faith in the only man who can get him home—the observer. When the carrier is reached, he must be able to "touch his aircraft down" at the correct time interval after the one in front of him, and he must be able to put his aircraft down in a circle on the deck some ten yards in diameter regardless of the ship's pitch or roll, by day or by night.

The pilot must be a talented young man, and the observer equally so, though his duties are less spectacular. In the N.A.A., as in the Luftwaffe, the observer may be the captain of the aircraft if he is senior to his pilot, for according to naval custom the senior officer takes charge. The observer is responsible primarily for the navigation of the aircraft. Unlike the pilot, who is strapped into his seat for the whole flight, the observer is able to move a certain amount; that is, he may sit down with his chart board on his knee or he may stand up. His floor space is something under a square yard and for this small mercy he must be content until the aircraft lands, but in this respect he is far better off than the pilot or the air gunner.

DUTIES OF AN OBSERVER

An observer must be able to view the weather with a critical eye and to interpret what he sees; he must also be able to identify the class and nationality of all warships sighted and of most merchantmen. His principal task in life, however, is to be able to report to his admiral in concise terms the composition and the tactics being adopted by an enemy fleet before action is joined. It is not too much to say that on the accuracy of an observer's information may depend the whole handling of our fleet and the decision of an admiral to seek or decline battle. It is a

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TACTICS EMPLOYED BY TORPEDO-CARRYING

These planes carry one large torpedo under the fuselage. Being slow, an erratic course is taken in attack. Before releasing their weapons, the planes get as close to their target as possible. This

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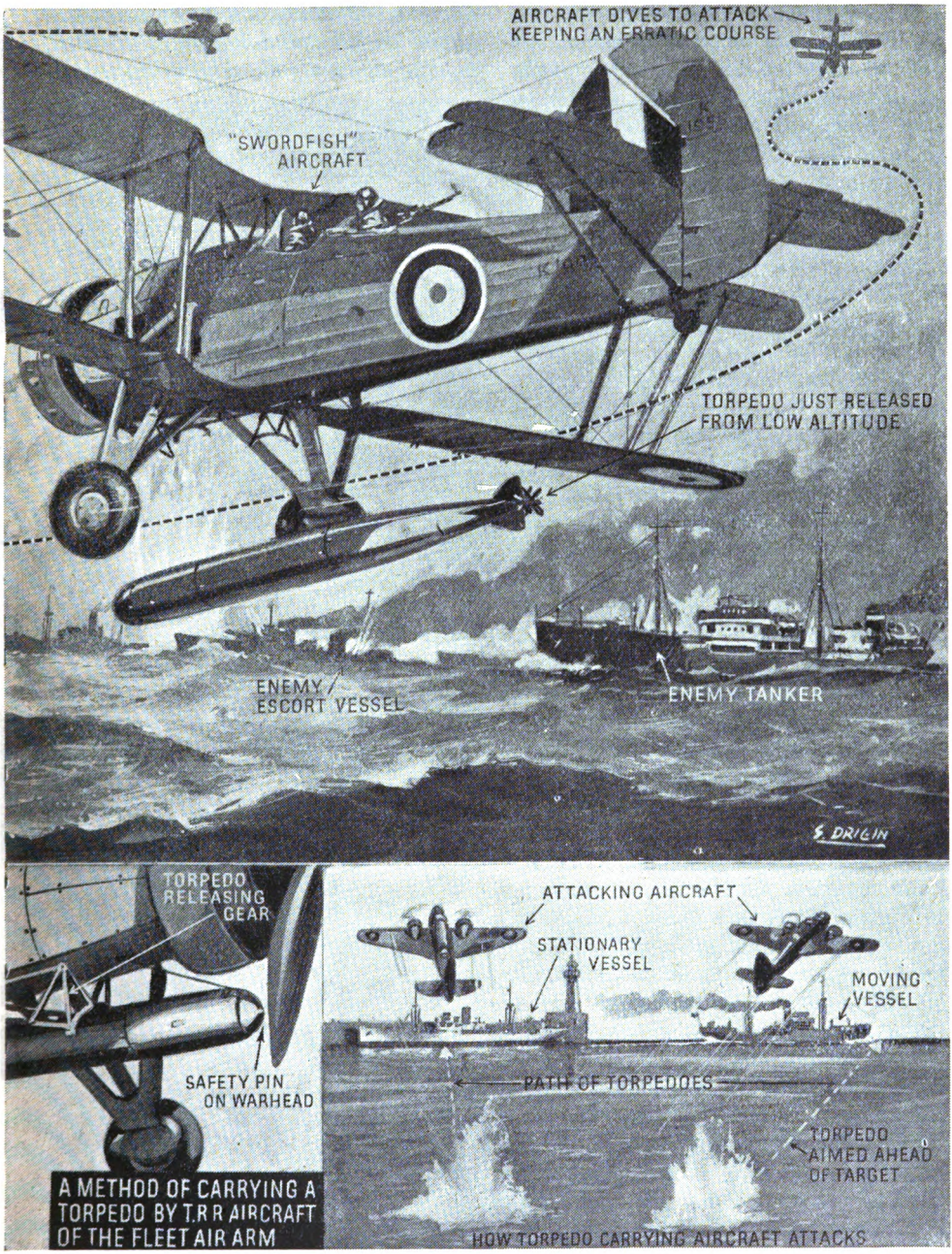
AIRCRAFT DIVES TO ATTACK KEEPING AN ERRATIC COURSE
"SWORDFISH" AIRCRAFT
TORPEDO JUST RELEASED FROM LOW ALTITUDE
ENEMY ESCORT VESSEL
ENEMY TANKER
S. DRIGIN
TORPEDO RELEASING GEAR
SAFETY PIN ON WARHEAD
A METHOD OF CARRYING A TORPEDO BY T.R.R AIRCRAFT OF THE FLEET AIR ARM
ATTACKING AIRCRAFT
STATIONARY VESSEL
MOVING VESSEL
PATH OF TORPEDOES
TORPEDO AIMED AHEAD OF TARGET
HOW TORPEDO CARRYING AIRCRAFT ATTACKS

AIRCRAFT OF THE NAVAL AIR ARM

low-level flying is very dangerous in the face of the A.A. fire of modern ships. The behaviour and course of such torpedoes is shown above; a hydrostatic device controls their depth

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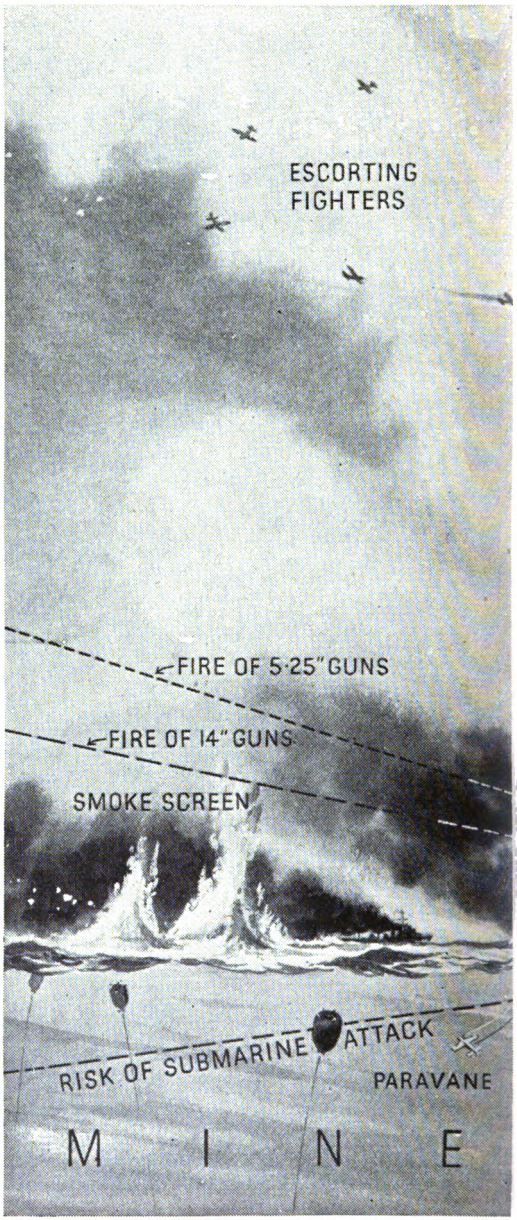
great responsibility for a young officer to be, possibly, an admiral's principal informant. Another duty which falls to the lot of an observer is spotting the fall of shot for the heavy ships when they come to grips with an enemy; to be able to do this he must have a good knowledge of wireless and be able to send, and receive, signals in morse at a high rate.

Usually the air gunner of the aircraft, the third member of the crew, is responsible for the wireless and signalling as well as for the handling of the single free machine gun, the Swordfish's only defensive weapon. He is the only member of the crew who is not an officer, for his responsibility to the senior officers of the Navy is much less than that of his two companions. Nevertheless, he is a vital part of the team if there is any signalling to be done; and, though the pilot and observer may gather all-important information for their fleet, it is of no use if the air gunner cannot pass it rapidly to the flagship. The last hope of a lost aircraft is always the air gunner. If he cannot let his ship know that the aircraft is in distress, hope of being rescued from the sea is remote. This may not sound difficult but it must be remembered that a carrier's aircraft, like the carrier herself, must not break wireless silence unless it is of great importance to do so. Though the routine tests are made daily on the wireless apparatus, it is always a matter of skill to get a message through if the set has not transmitted for months on end.

Sometimes it is necessary to send naval reconnaissance aircraft beyond their normal range for special purposes. An example of this was when Swordfish were used for mine laying off the Dutch and German coasts in 1940, the Royal Air Force having their hands full in dealing with the Luftwaffe and the threat of invasion. To do this it was necessary to give up one member of the crew and to put in an extra petrol tank. The air gunner was then left behind and the observer had to take on his duties as well as his own, though signalling is always kept to a



OFFENSIVE AND

On the left, the main and secondary armament of 14-in. and 5.25-in. guns respectively are

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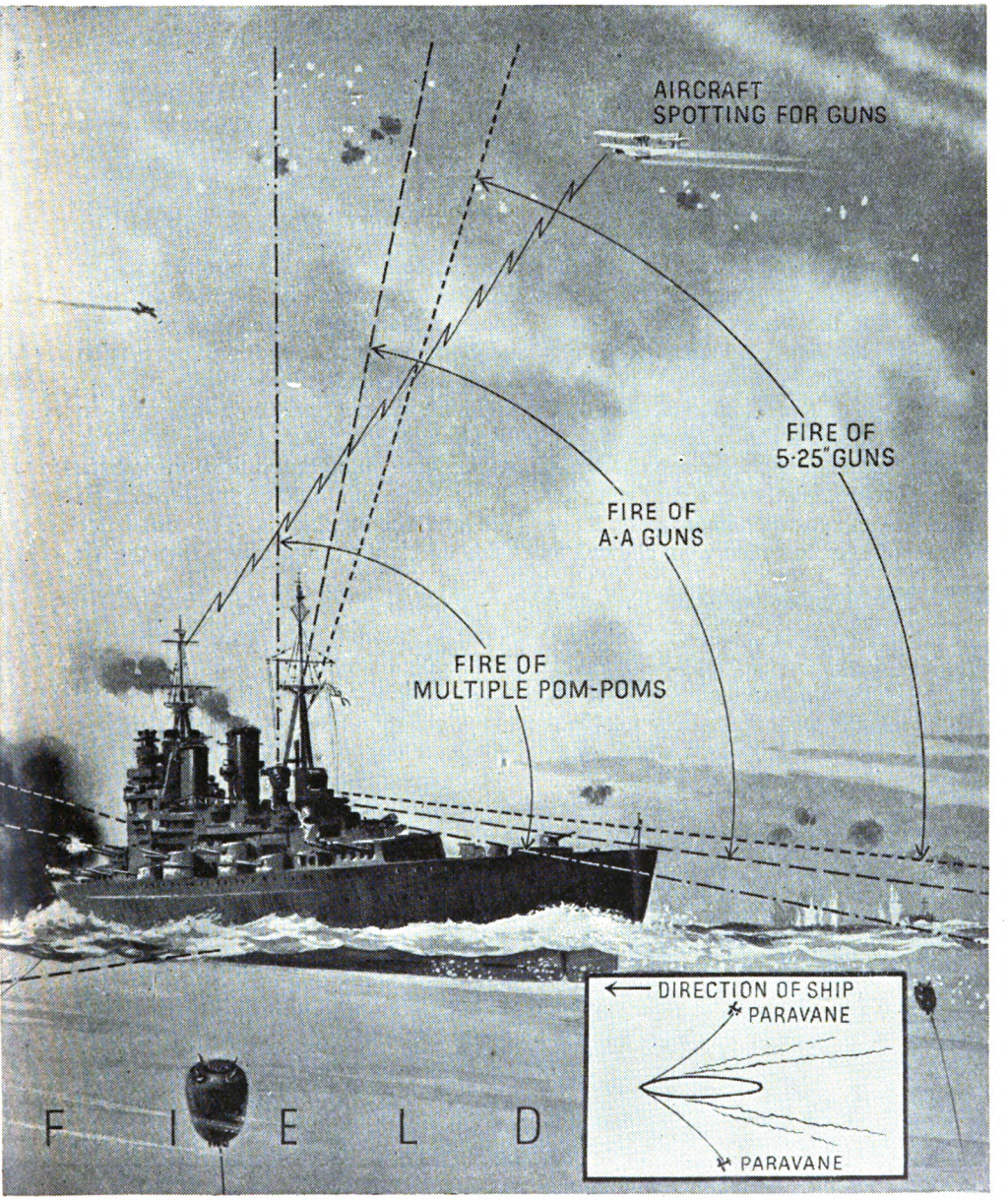
minimum on these operations. As such flights are usually undertaken at night, the strain on the pilot and observer is considerable. They may be alone in the air for any time up to seven hours, the pilot concentrating on his instruments the



DEFENSIVE ARCS OF FIRE OF A BRITISH BATTLESHIP'S GUNS
firing. On the right, the high angle of fire possible for the 5.25-in. guns, A.A. guns and pom-poms is clearly to be seen. Constant watch is always kept for enemy submarines and mines

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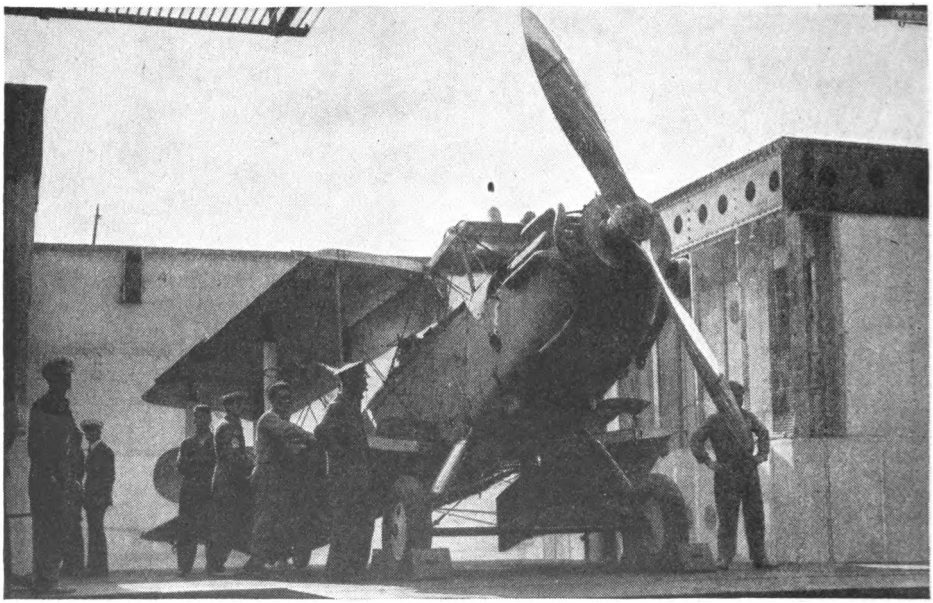
whole time and the observer navigating, listening for signals and watching astern for signs of hostile night fighters. The fitting of long-range tanks in aircraft is always viewed with despondency by the air gunners whose place they take. They are as keen on their flying as the pilot and observer and hate being left out. Their absence is also felt by the other two who know that a good air gunner is well worth his weight in petrol.

In 1939 the policy of the previous twenty-two years was reversed and the Admiralty was again given control of the N.A.A. But the damage that had been done by the amalgamation had been catastrophic. The Naval Air Arm was in future to be a wholly naval service and all R.A.F. pilots and maintenance ratings were to be withdrawn as soon as possible, as they were urgently needed to meet the rapid R.A.F. expansion in progress. A few R.A.F. officers and men were allowed to transfer to the Navy, but the loss of almost half the trained pilots of the N.A.A. at a time when Hitler was invading Czecho-Slovakia was a heavy blow. There were no naval aircraft maintenance ratings to replace those of the R.A.F., so the latter had perforce to remain until others could be trained. The only nucleus on which the Admiralty could build was the handful who had decided to stick to a seafaring life. Since then the Admiralty has succeeded in meeting its requirements and now there are very few of those in the R.A.F., to whom the N.A.A. owes so much, left in the carriers. The N.A.A. is now manned by naval ratings and it is on these that its efficiency depends.

There are no twin-engined aircraft in the Navy. Whether an aircraft will fly or not depends therefore on the performance of one engine and that engine depends on the men who overhaul it. The confidence with which the naval crews take the air



"STRIKING DOWN" A NAVAL AIRCRAFT

Carrier-borne aircraft have wings that can be folded back so that every inch of space in the hangars can be utilized. The aircraft are lowered, or struck down, from the flight deck to the hangar on lifts like that seen above. All necessary repairs are carried out below deck

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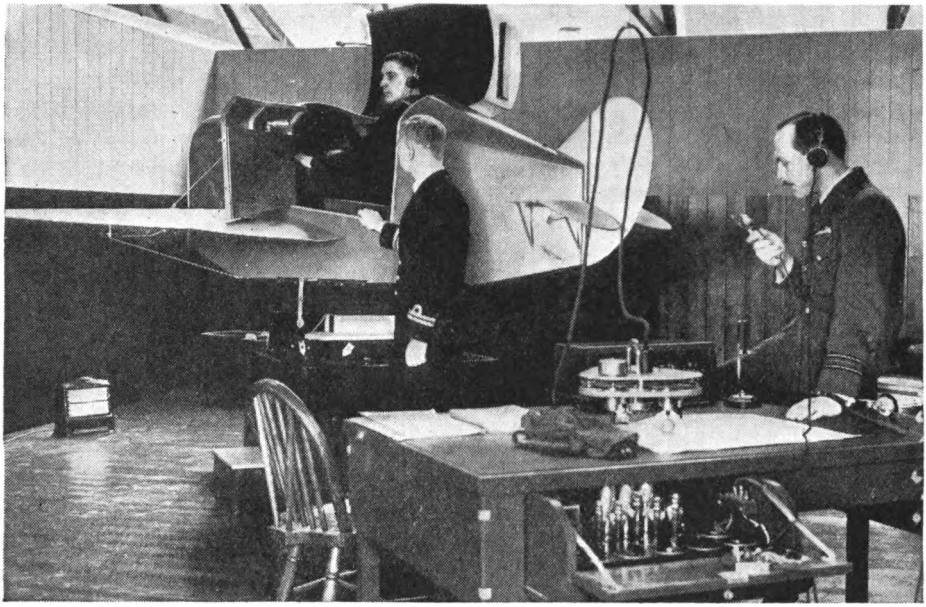

LEARNING TO "FLY" ON THE GROUND

The Link trainer, seen above, is used to train embryo pilots in aircraft control. The dummy fuselage answers to the movements of the control column in the same way as a real aircraft, and the pilot's course is traced by an electrical device, known as a crab, on the instructor's desk

in their old-fashioned looking aircraft is an exact measure of the trust they have in the men who work night and day in the crowded hangars of a rolling and pitching ship to keep the aircraft continually serviceable. It may make a great difference to a fleet how many aircraft can take off for an important operation. That number depends entirely on the careful and unfailing work which the air crews of the Navy have come to expect from their "ground staff." One case will serve as an example. As the aircraft were taking off from H.M.S. *Illustrious* to raid Taranto, one was damaged so that it could not fly. It was hurriedly moved aside until the rest got away and then was turned over to the maintenance crews to see what they could do about it. By then it was well past midnight and most of the men had been up all day putting finishing touches to their various machines. They set about repairing the plane, however, with such energy that the damaged member was replaced in time for the aircraft to attack before dawn. And attack it did, all alone, and scored two hits on an Italian cruiser with heavy bombs.

It is impressive to watch aircraft landing on their carriers after their return from a flight, and to see the speed with which they are handled and got clear of the deck in order to leave a space for the next arrival. Whenever aircraft are to be flown on or off, the carrier must turn to steam almost into the wind. It is only too often found that the way the carrier wishes to go and the way from which the wind is coming are very different; it is then of the greatest importance that there should be no unnecessary steaming in an undesirable direction. The flight deck crew are therefore picked men, usually sailors by trade who have adopted a foster-mother attitude to aircraft. They must be even smarter than their fathers in the days of

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sail, for aircraft are peculiar things to handle. There is very little room on the flight deck, and one false move may mean sudden death from a whirling propeller or a sixty-foot fall into the sea. When an aircraft has landed and has been brought to a standstill by the wires stretched across the deck for this purpose, two men rush out to release it. As soon as the wire has dropped clear, the pilot is given a signal and taxies his plane forward while two more men run with it, holding on to the wing-tips. The wire is drawn back into position and the deck is cleared ready for the next aircraft, which will be now approaching the stern and waiting for the signal to land. "Striking down" is then begun; the aircraft are wheeled on to the huge lifts and lowered to the level of the hangars, there to be refuelled and gone over with the greatest thoroughness.

The N.A.A. is not confined to carriers but has its aircraft in all the larger ships of the fleet. Every cruiser and battleship carries at least one and sometimes four aircraft which she uses mainly for reconnaissance, spotting, or anti-submarine patrols. These aircraft are descendants of the original seaplanes used with the Grand Fleet in the war of 1914-18 though they no longer have to be lowered into the sea, but can be catapulted into the air. As one would expect, they are also much better aircraft.

VICKERS WALRUS

The type most used is the Vickers Walrus, capable of landing on sea or shore, or on the deck of a carrier. It has the hull of a small flying boat and a pair of landing wheels, which are tucked up into the lower wing when not in use. Its speed is even slower than that of the Swordfish, eighty-five or ninety miles an hour being its best. They are handy craft and can be landed in very rough seas; as explained earlier, this is a necessity if the aircraft carried in a ship such as a cruiser are to be worth the space they occupy. The other type of aircraft used for this work is the Seafox, with a float undercarriage; they are not quite so suitable as the Walrus, but they provide a good second string.

The Walrus of cruisers and battleships have done a great deal of useful work in war but have received little publicity or thanks. Several German raiders and supply ships have been found by them and, later, have been sunk by the parent ships. They were employed extensively in the Norwegian campaign, in the Mediterranean (notably to spot for the famous "Force H" when it bombarded Genoa, ensuring serious damage of the Italian dockyard and factories), and they even dive bombed the army headquarters when Italian forces occupied Berbera in 1940. They are the most ungainly and noisy aircraft in the British air forces. They look about as capable of taking the air as a steam roller and they are known throughout the Navy as "Steam Pigeons."

AIRCRAFT AND TACTICS

The advent of aircraft, both land and shore based, has complicated the work of admirals as much as it has interfered with the life of civilians ashore. To describe the effect of aircraft on naval tactics would need a whole book, but a brief summary can be given here. It is in the field of reconnaissance that they have made most difference to naval warfare; they have completely replaced the cruiser and destroyer in this duty. With their greater flexibility, they can search rapidly any desired area of sea or even the bases of the enemy fleet, giving the admiral a complete picture of the situation in far less time than could any ship. They have made it possible for a slower fleet to avoid action, if it so desires, or for a smaller but faster force to choose its moment to strike a powerful and damaging blow.

Their power to damage ships has been extensively proved. It is noteworthy that

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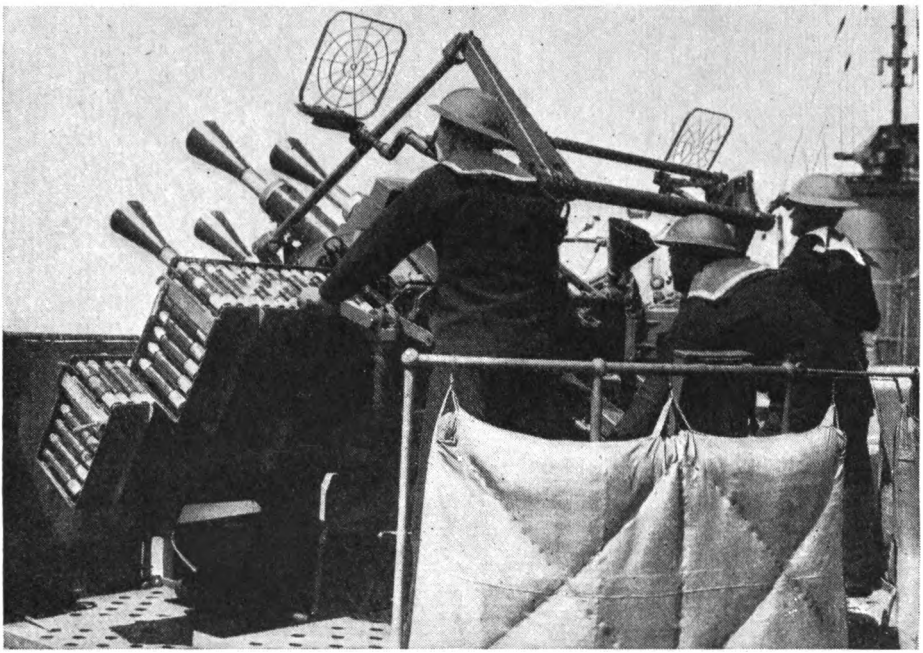
this power extends equally to ships at sea or in harbour, meaning that no fleet can ever wholly relax again, for the threat of air attack is always present. Fleet bases have, in consequence, to be protected by large numbers of guns and men, who might otherwise have taken a far more active part in the war. At sea the ability of aircraft on occasion to pursue and stop fleeing enemy ships has been more than once demonstrated during the course of the Second World War.

The only real defence against aircraft attack has proved to be the fighter aircraft. Gunfire from ships serves as a deterrent and may bring down a few aircraft, while high speed and alterations of course by ships may dodge a few bombs or torpedoes. In general, however, neither will stop a determined attack or avert its consequences if the right weapons are used by the aircraft. It must also be remembered that fighter aircraft sometimes fail to stop an attack and there have been occasions, too, when gunfire has sufficed to drive off bombers.

One of the principal duties of aircraft carriers is nevertheless to provide fighter protection for itself and its escorting capital ships, destroyers and cruisers. Today more than ever before the admirals are trying to find out how to make the small number of fighters borne in a carrier provide the most adequate protection to the 35,000-ton monster battleships. It is an admiral's unquestionable and vital need to have immediately available the largest possible force of aircraft for self-defence and for attacking the enemy. This need has made the carrier with its scores of tiny aircraft, an essential constituent of the modern British Navy.



CREW OF A MULTIPLE POM-POM GUN AT THE ALERT

Patrol vessels have to be constantly on the watch for enemy aerial attack. Multiple pom-pom guns set up a tremendous curtain of fire and are very deadly against low-flying aircraft

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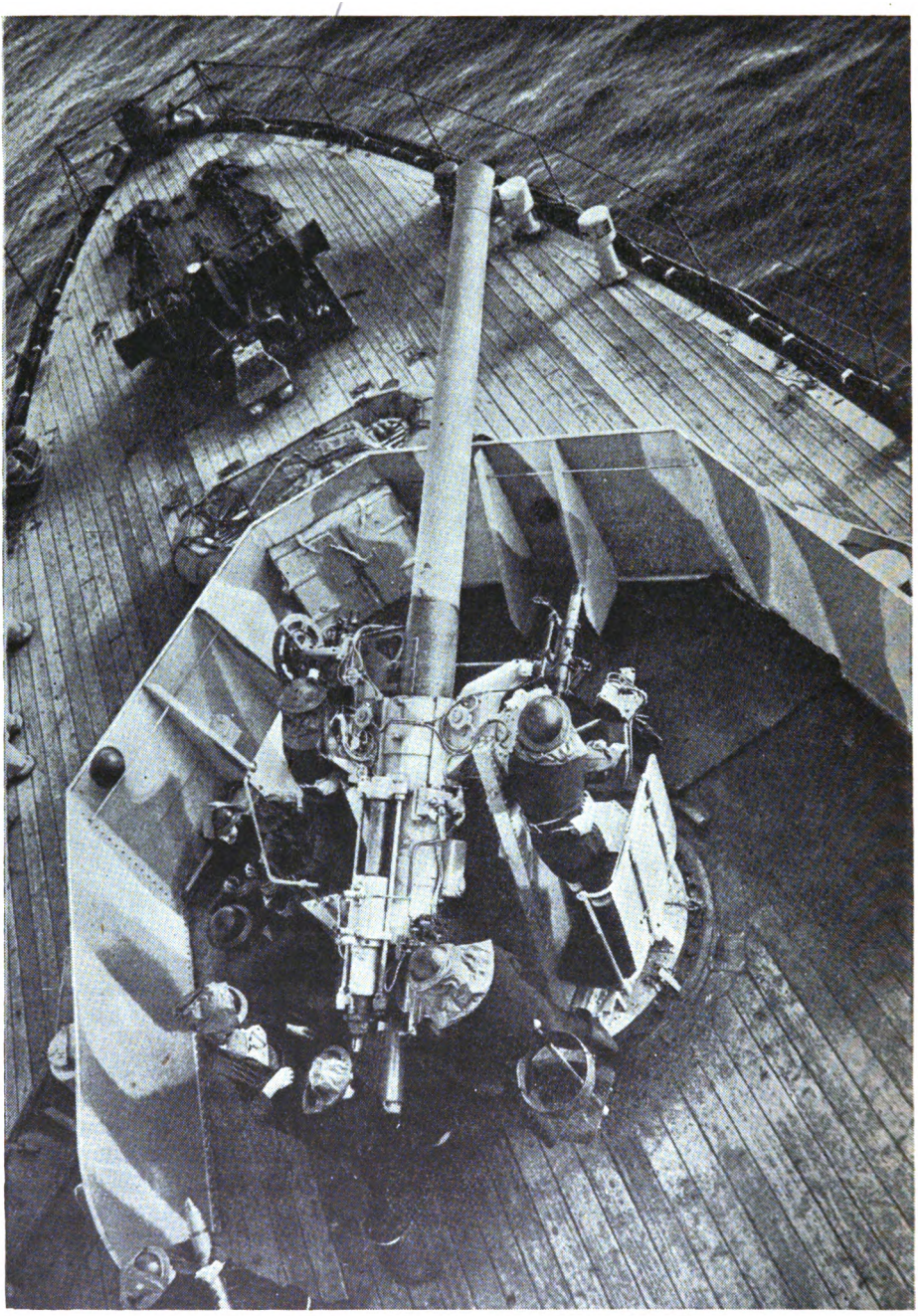

A BRITISH DESTROYER ON ESCORT DUTY

Convoys of British shipping are guarded in wartime by destroyers, patrol vessels and armed merchant cruisers. The forward gun's crew of a destroyer is seen here at action stations

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CHAPTER 8

Cruisers and Destroyers

Cruiser varieties. Battle cruiser actions. Vastness of oceans. Difficulties of search. Pocket battleships. Control of fire. Submarine dangers. Armed merchant cruisers. Origin of the destroyer. Difficulties of command. Training of crews. Convoy work. Sloops. The torpedo. The flotilla leader. Organization for attack. The element of surprise

NAVAL experts would agree that it is rather difficult to lump cruisers and destroyers together under one heading, but the duties of these to a certain extent overlap. And destroyers of today have the same displacement as, but double the speed of and a considerably stronger armament than, the third-class cruiser of forty years ago.

Under cruiser we include a variety of vessels of very different types and sizes. These, like the Navy as a whole, are something of a compromise between the requirements of the Naval Staff and the Naval Constructor, and perhaps the Treasury. In the battle cruiser we find a ship which was designed to fulfil the functions of a cruiser and yet reinforce the extremities of the line of battle while engaging an equal or superior force.

BROUGHT TO ACTION

The most noteworthy use of battle cruisers was, perhaps, at the Battle of the Falkland Islands, in the war of 1914-18. Only with such ships available could the powerful German ships have been brought to action. Lord Fisher saw the chance, took it and used the only weapons which could have brought about such a resounding result. It may be argued that it was lucky for us that the German ships under Admiral Graf Spee elected to go to the Falkland Islands, but the fact remains that only battle cruisers could have crushed and annihilated so formidable an enemy as that.

Turn to another battle cruiser action, in 1941, involving the tragic loss of H.M.S. *Hood*, the most beautiful ship ever built, a perfect example of the shipbuilder's art, carrying the most modern weapons and every device that science and practical experience had made available. A great deal of money had been spent on H.M.S. *Hood*, not only at the time of her construction but in extensive alterations to bring her up to date. She had speed, endurance, and hitting power; but lack of vital protection proved fatal.

True it was that, at the range at which she was engaged, it was a lucky—or rather unlucky—salvo which knocked her out. But who can doubt from the record of the hammering that the enemy *Bismarck* eventually withstood that the end of the action between H.M.S. *Hood* and the *Bismarck* would have been the same without that "lucky" hit which H.M.S. *Hood* received so soon after the commencement of the action.

It is not possible within the space available to describe in detail all the different categories of cruisers; suffice it to say that two main classes which emerged from the Washington Conference were the 8-in. and 6-in. gun cruisers. The tonnage of the former—the County

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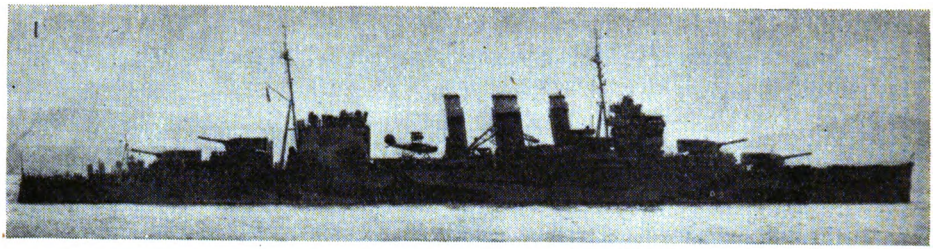
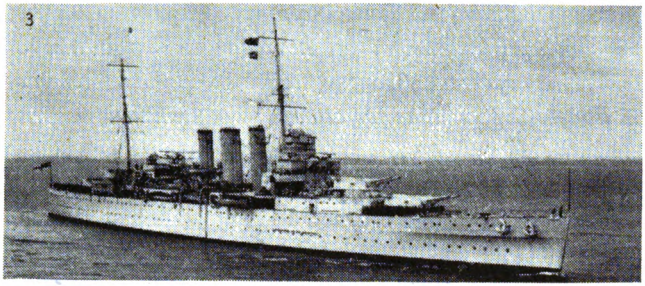


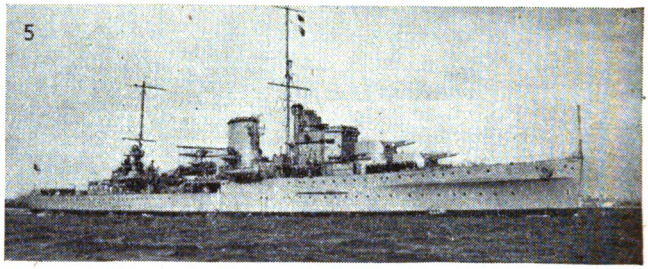


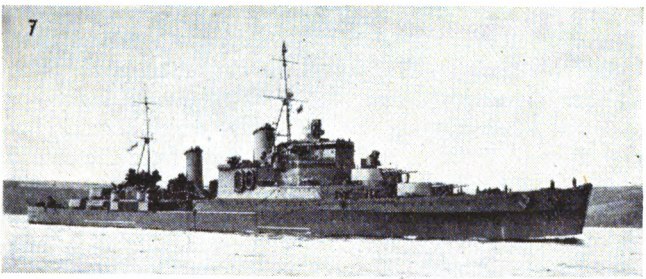
TYPES OF

Cruisers are designed to protect capital ships and convoys. It is essential for them to have a great range and speed, together with a heavier armament than destroyers. There are many different types in use in the Royal Navy. The most representative of them are shown here.

3. "LONDON" CLASS. *Displacement:* 10,000 tons. *Main armament:* eight 8-in. guns. *Aircraft:* one. *Speed:* 32·25 knots. *Complement:* 650.

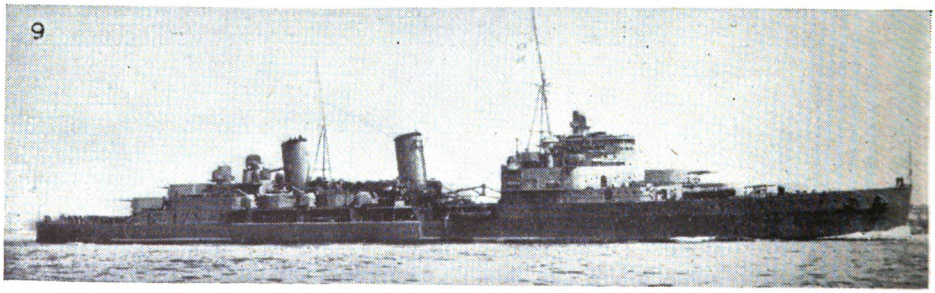
5. "LEANDER" CLASS. *Displacement:* 7,200 tons. *Main armament:* eight 6-in. guns. *Aircraft:* one, or two. *Speed:* 32·5 knots. *Complement:* 550.





7. "SOUTHAMPTON" CLASS. *Displacement:* 9,100 tons approx. *Main armament:* twelve 6-in. guns. *Aircraft:* three. *Speed:* 32 knots. *Complement:* 700.

9. "EDINBURGH" CLASS. *Displacement:* 10,000 tons. *Main armament:* twelve 6-in. guns. *Aircraft:* three. *Speed:* 32·5 knots. *Complement:* 700.



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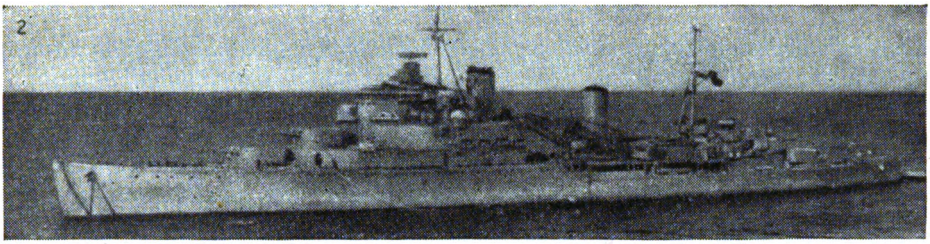
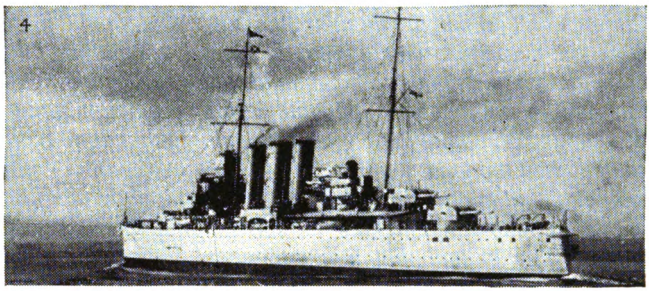
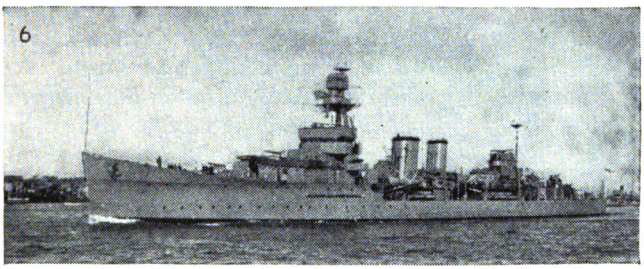


BRITISH CRUISERS

1. "DORSETSHIRE" CLASS. *Displacement:* 10,000 tons approx. *Main armament:* eight 8-in. guns. *Aircraft:* one. *Speed:* 32·25 knots. *Complement:* 650.

2. "FIJI" CLASS. *Displacement:* 8,000 tons. *Main armament:* twelve 6-in. guns. *Aircraft:* three. *Speed:* 33 knots. *Complement:* 650.



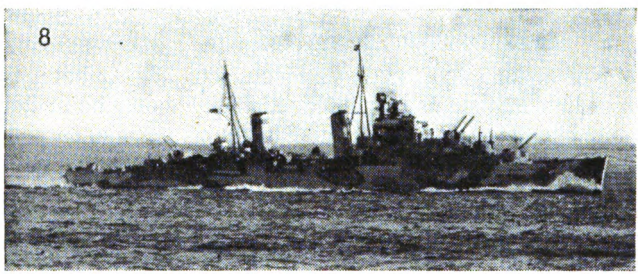


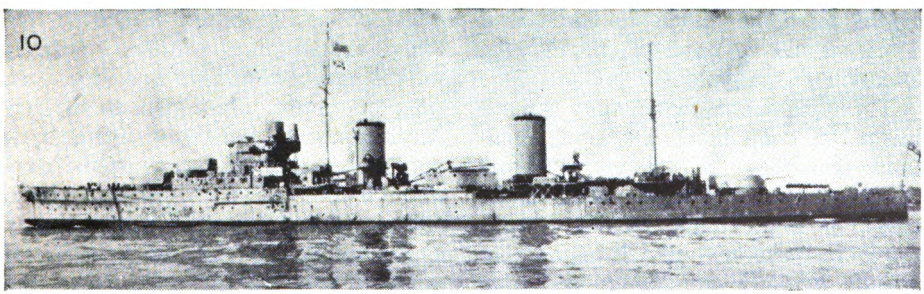
4. "KENT" CLASS. *Displacement:* 10,000 tons. *Main armament:* eight 8-in. guns. *Aircraft:* three. *Speed:* 31·5 knots. *Complement:* 680.

6. "D" CLASS. *Displacement:* 4,850 tons. *Main armament:* six 6-in. guns. *Aircraft:* none. *Speed:* 29 knots. *Complement:* 450 approx.

8. "DIDO" CLASS. *Displacement:* 5,450 tons. *Main armament:* ten 5·25-in. guns (in five turrets). *Aircraft:* one. *Speed:* 33 knots. *Complement:* 550.

10. "ARETHUSA" CLASS. *Displacement:* 5,270 tons. *Main armament:* six 6-in. guns. *Aircraft:* one. *Speed:* 32·25 knots. *Complement:* 450.





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class—was limited to 10,000 tons, that of the latter to about 5,000 tons.

We were unlucky in the early ships of the County class. The guns were carried too low, and being mounted in casemates which projected from the ship's side, the sea in average weather was thrown up over the guns, considerably handicapping the crews. The ships, taken as a whole, were not a success. In the next County class, design went to the other extreme, and a ship with a very high freeboard was the result. These were good steamers but exposed too great a target. They were imposing in appearance, and therefore useful in "showing the flag" in Eastern waters. The classes that followed were splendid vessels admirably adapted to fulfil the services for which they are required. Probably the best-known of the 8-in. gun cruisers was H.M.S. *Exeter*, which stood up to severe punishment at the battle of the River Plate.

Of the 6-in. gun cruisers H.M.S. *Ajax* and *Achilles* figured well in the same battle, and later H.M.S. *Penelope* and *Aurora* gained fame in the annihilation of an Italian convoy in the Mediterranean.

EYES OF THE ADMIRAL

Not so long ago the duties of cruisers could have been fairly well defined. They were the same as those of the frigates of old—to be the eyes of the admiral, and to bring him information. The duty remains, but Germany has no fleet in being, so her activities are limited to raiding. These raiders vary in size from armed merchant vessels to battleships. These would, of course, demand the attention of our battle fleet.

The information that raiders are out might well come first from the depredations that they are committing, from watching aircraft working from shore bases, or from aircraft carried by our ships. It must be borne in mind that aircraft working from a cruiser have definite limitations. Launching by means of a catapult is now technically efficient, but its successful use is still subject to wind and the movement of the ship. The aircraft must be small and have a limited launching weight, which means a comparatively short flight endurance.

RANGE OF VISION

Landing on the ship from the air at the end of a reconnaissance flight is not possible; landing on the sea is extremely hazardous except in calm weather. If the weather is not fine, it is generally possible to save the pilot but seldom the machine. From a practical point of view, while the presence of an aircraft on board may on occasions increase the range of vision of a searching ship from a radius of ten miles to one of 200 miles, such an area is still small compared with an ocean.

Ship-flown aircraft (other than aircraft flown from carriers) may be said to be useful up to about 3,000 miles from land —in certain conditions, as in the tropics, where calm water may be expected over wide stretches. But carrying aircraft in a cruiser entails a sacrifice of armament.

With the huge distances now flown by shore-based aircraft of the Sunderland flying-boat type, future developments may be in the direction of the co-operation of such aircraft with the ships rather than the use of small aircraft carried by the ship itself.

The oceans are vast. The largest—the Pacific—covers some 64,000,000 square miles; the smallest—the Arctic—some 5,500,000 square miles. Moreover, the oceans are all joined together by water, so that raiders can move in a short time from one quarter of the globe to another. A raider known to be in a definite spot can, within twenty-four hours, be anywhere within an area of 700,000 square miles, provided land does not intervene. This mobility, combined with the size of the water space of the globe, makes the

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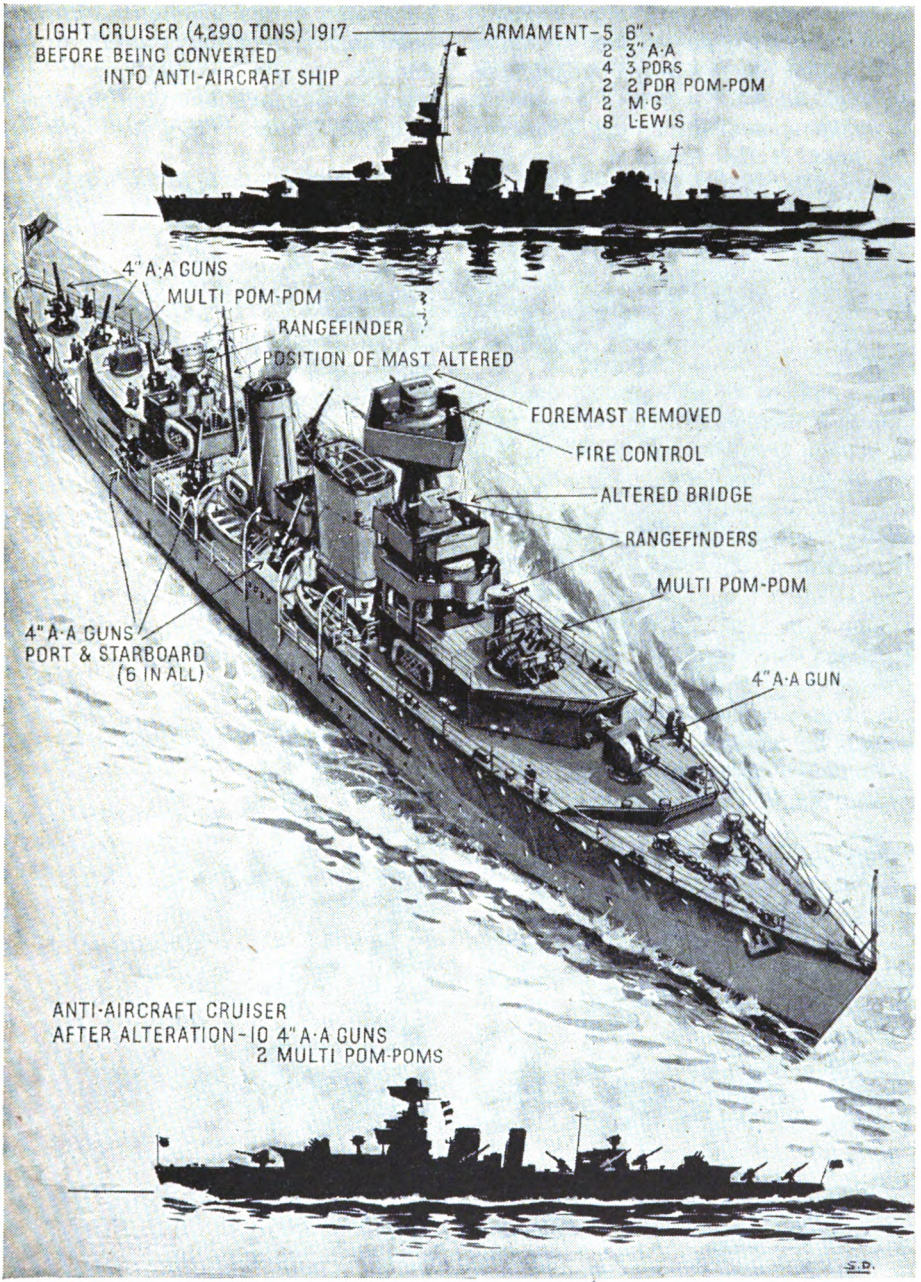

A LIGHT CRUISER CONVERTED INTO AN A.A. SHIP

***To** provide convoys with protection against aerial attack, old-type light cruisers are converted into A.A. ships. The fire from the concentrated A.A. armament on such ships is deadly*

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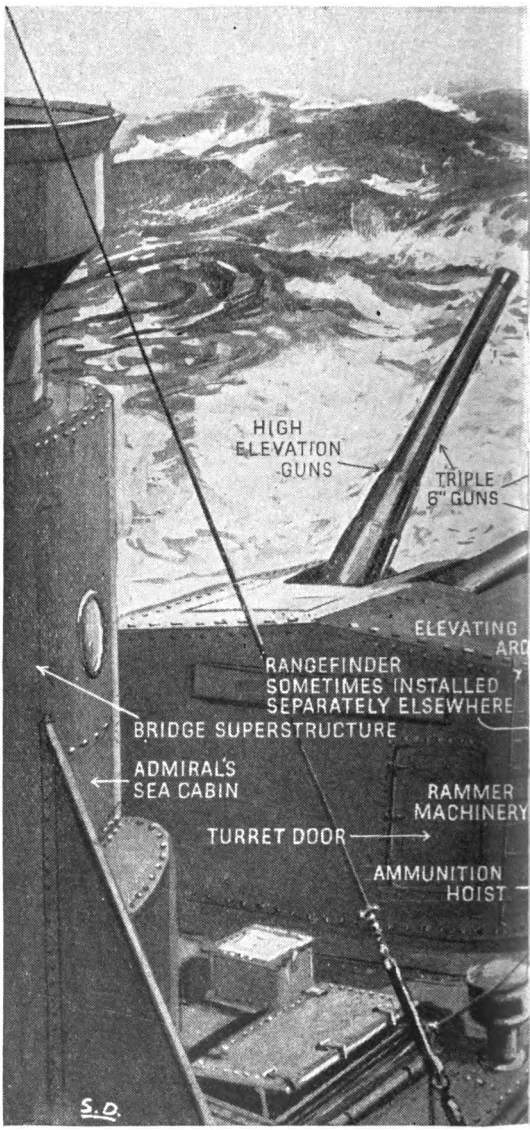
hunting down of raiders by cruisers a most difficult and complicated operation.

Whatever may be the source of information of the whereabouts of a raider, it is the business of the cruiser to take up the hunt. If the enemy is in superior force he must be shadowed, and his course and speed reported so that he may be intercepted by other ships at the disposal of the admiral responsible for that particular part of the ocean. Or it may be that intercepting action may be taken on receipt of far-distant reports.

We have in the fight against the *Graf Spee* a classic example of another form of action. This German raider was only one degree less formidable than the *Bismarck*, a so-called pocket battleship. Battleship—because she was armed with large calibre guns; pocket—because her displacement was only the same as that of our 8-in. gun cruisers. This ship the Germans considered to be the last word in commerce raiders, too powerful for any cruiser to tackle and too fast to be caught by the fastest battleship.

At the commencement of the Second World War we had only three ships that could match the pocket battleship in speed and armament. We had considerable respect for the pocket battleship; she presented a difficult problem for any of our cruisers that chanced to meet her unsupported. Commodore (later Rear-Admiral) Sir Henry Harwood supplied the answer. When cruising off the South American coast he had news of the whereabouts of the *Graf Spee*. He rightly deduced that she would disappear from the particular part of the ocean where she had been reported, and that she would make for one or other of the most-used trade routes.

So he gathered together his little force of three cruisers, each of which alone would have been easy prey for the enemy. By laying his plans so that all three should be in action together he won a remarkable victory. His forecast had been accurate, and the enemy steamed straight into the trap that had been laid for him, almost as soon as it had been completed. The bogy of the pocket battleship was



DIAGRAMMATIC DRAWING

The forward armament of this type of British cruiser consists of two triple turrets of

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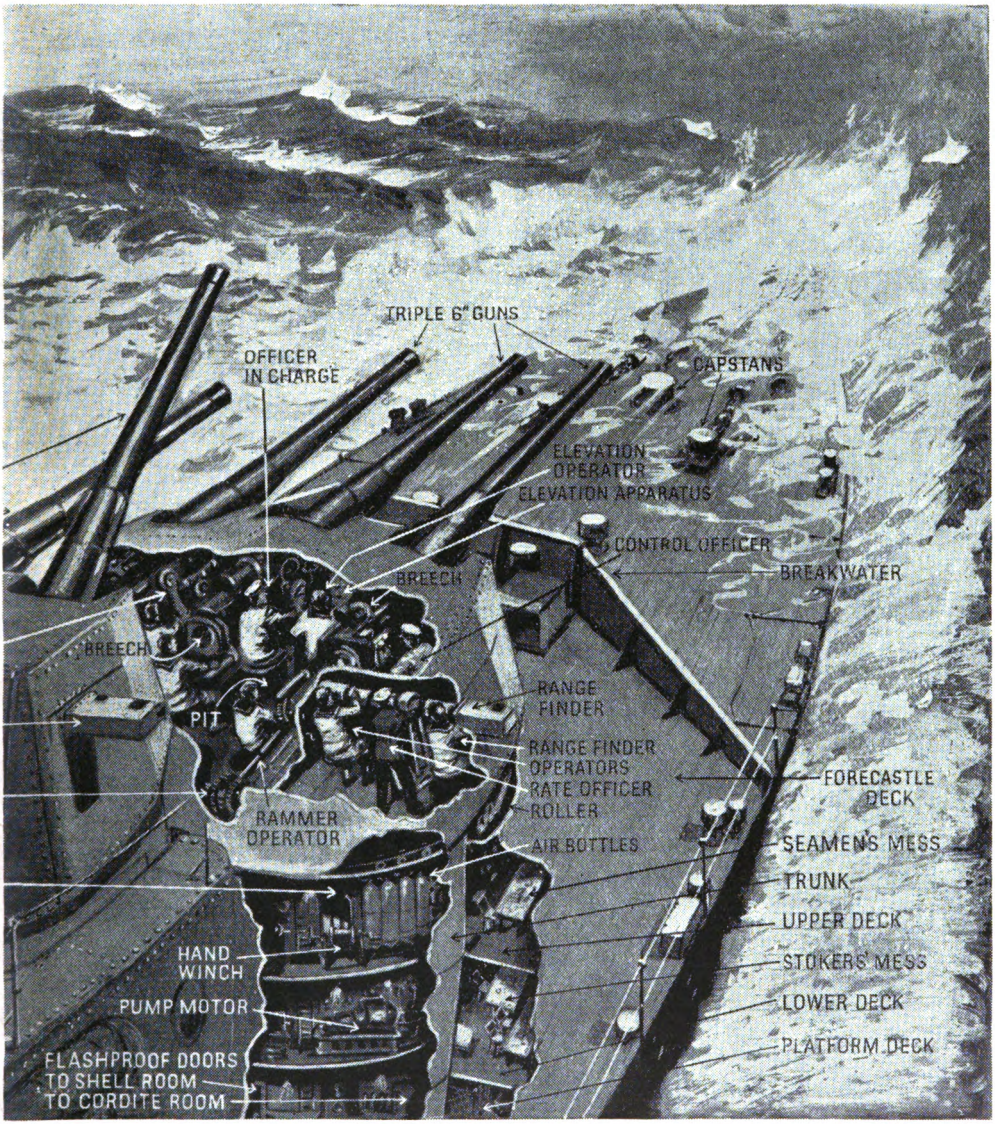
exploded. The secret of success was the setting of a task altogether too difficult for the enemy's fire control.

For many years past the whole of a ship's guns have been operated and fired by one controlling hand. By this means the greatest volume of fire can be concentrated at will on to any target or part of a target. But should the controller of the guns be faced with a number of



OF THE FORWARD TURRETS OF A BRITISH 6-IN. GUN CRUISER

6-in. guns. Underneath the officers and men working the various instruments and firing the guns is the trunk to the cordite room. Near the foot of this trunk are flash-proof doors

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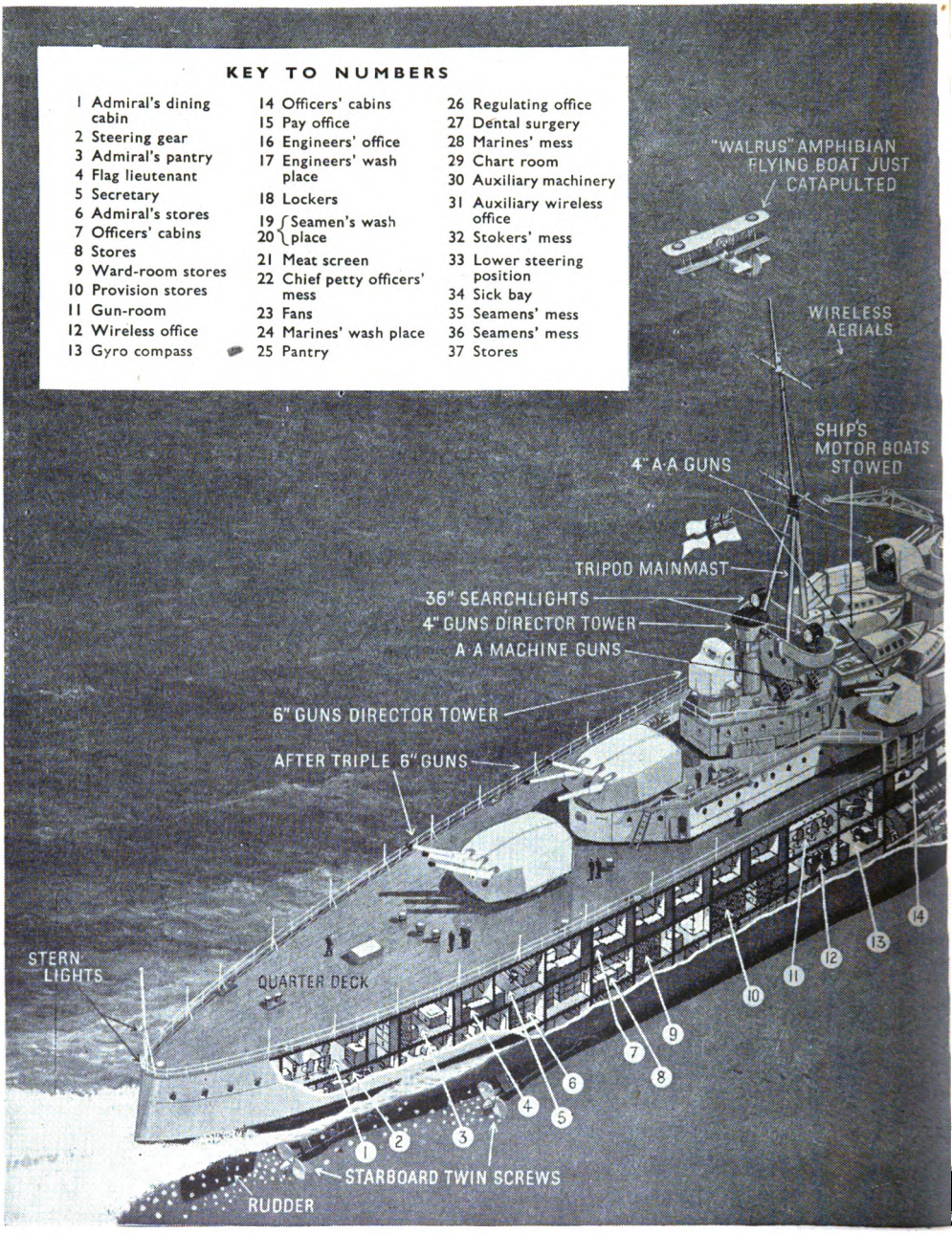

DIAGRAMMATIC DRAWING OF A BRITISH

These cruisers have a displacement of 9,400 tons and their 82,500-h.p. engines give them an approximate speed of thirty-two knots. Their armament consists of twelve 6-in. guns and eight 4-in. A.A. guns, besides two multiple pom-poms and numerous smaller guns. Two sets

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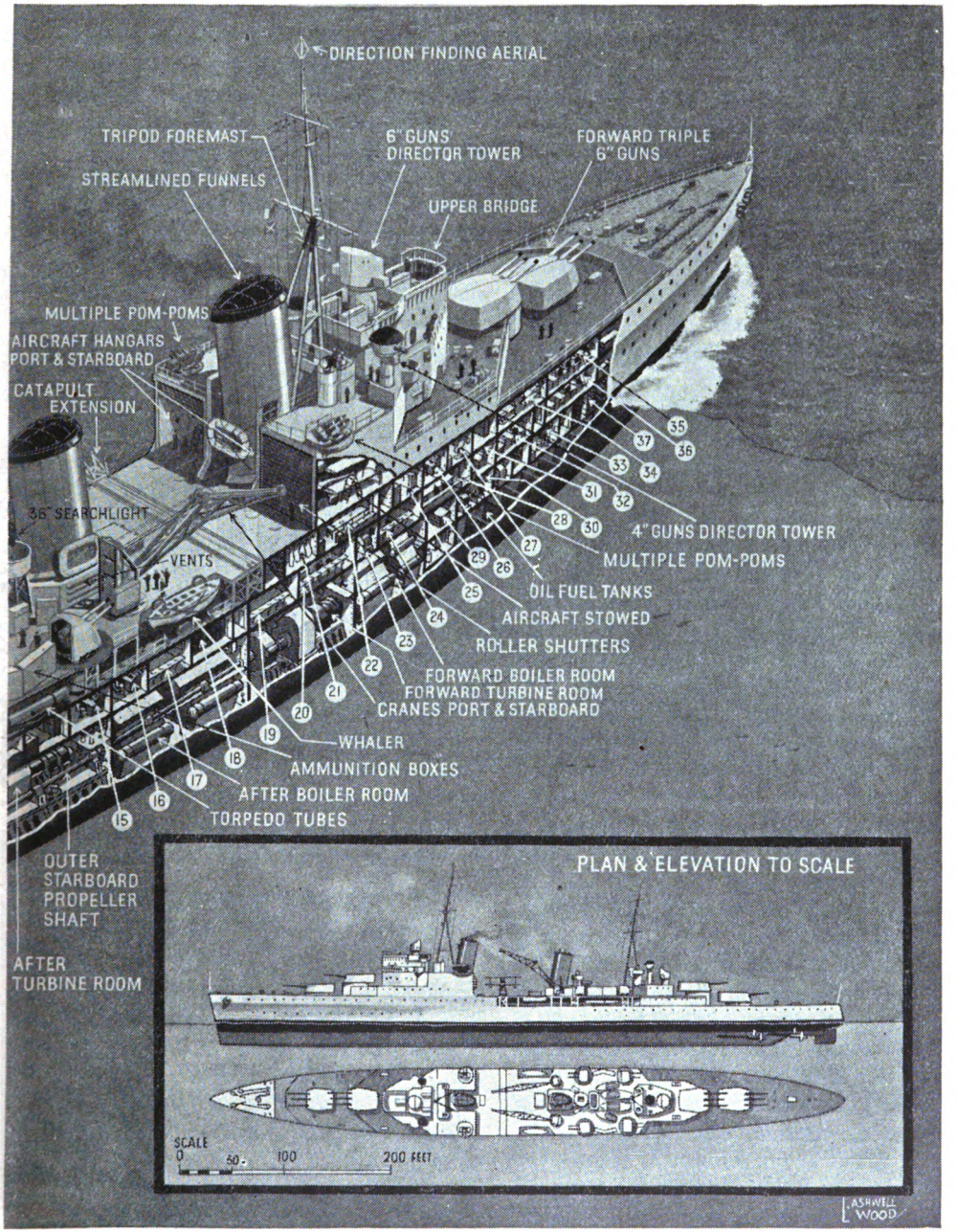

CRUISER OF THE SOUTHAMPTON CLASS

of triple torpedo tubes are fitted, one to port and one to starboard. Their length is 590 feet, their beam is sixty-one feet, and their complement is 700. To increase their reconnaissance range, these ships carry three Walrus flying-boats which are flown from a catapult

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targets simultaneously, he is confronted by a very difficult task. If he fires at one ship only he runs the risk of being fired at by the ships which are not being attacked. If he breaks down his control and fires at more than one ship at the same time he makes the work of his spotters extremely difficult; a condition that also results if he switches his fire alternately from one target to another, for there will be a loss of accuracy while he is finding the range each time that he moves on to a fresh target.

VARIETY OF RAIDERS

Apart from the big vessels the *Bismarck* and the *Graf Spee* and similar ships, there are a variety of other raiders: smaller cruisers or converted merchant ships which, operating on the trade routes and supplied from various sources with good information as to what ships are in the vicinity, can cause great damage by picking up single ships one by one. Should any of them be in a position to attack a weakly protected convoy they may sink many ships in a short time.

At last, we in England are coming to realize that the Empire depends for its existence on free communications, that England must draw on the markets of the world for her food, that those markets are far distant and vulnerable all the way. Much can be done in the future (as it should have been done long since) to protect shipping by the use of the Air Arm in the regions of focal points where trade routes must converge, but there still remains the great ocean where a raider can not only operate but lie hidden when the hunt becomes too hot.

There is one other type of raider—the submarine, against which the cruiser must always be on guard. A big cruiser, or an aircraft carrier on cruiser work, is in daylight or even in a normal tropical night very conspicuous and easily picked up at a great distance, even from the deck of a submarine. And of late years submarines have had their vision considerably extended by information conveyed to them by reconnaissance aircraft.

The safety of the cruiser from submarine attack lies in vigilance and speed. High speed entails a large consumption of fuel, and therefore a reduction in the time for which she can remain on her beat. And so the submarine menace raises the number of cruisers that are required to protect our commerce.

It is hoped that we shall never again let our cruiser strength fall to the low level at which it stood at the outbreak of the war. Cruisers in peace time are good ambassadors; in wartime they are indispensable. Numbers and quality are required rather than size. Not long since there was fought at the Admiralty, under Lord Beatty, what was known as the "battle of the cruisers." The Sea Lords insisted that seventy cruisers was the minimum required for safety; a modest number, in all truth, yet the Cabinet tried to whittle this down to fifty. The battle was won, only to be lost later on with a change of government, with the result that we started the war short of cruisers, and had once more to fall back on armed merchantmen to fill the gap.

ARMED CRUISERS

The gallantry of the officers and men in such ships, as exemplified by the heroic story of the armed merchantman H.M.S. *Jervis Bay*, is beyond all praise. The *Jervis Bay's* duty was to protect her convoy against a possible surface raider, yet could this be done? Can a liner with a few medium-sized guns mounted in her give battle to a warship? The armed cruiser can at the best only divert the attention of the raider from the convoy and give the ships some start in their endeavour to escape. She is bound to be sunk in the end; but her efforts will, in all probability, not have been in vain.

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The ships of the convoy can at least disperse, make smoke—in fact, take all possible steps to save themselves.

Not so the armed liner; she must steam out and endeavour to cover the retreat of her charges—steaming to a certain end. True, she may be of service by engaging a vessel of her own class; but that ship is not likely to risk having her whereabouts reported by attacking the convoy, or risk damage from the guns of the convoyed vessels themselves.

TWO OF BRITAIN'S MODERN CRUISERS

These modern Dido class cruisers mount three twin turrets of 5.25-in. guns forward and two similar turrets aft. They carry one aircraft. Their displacement is 5,450 tons and speed 33 knots

Let us therefore ask the people of the Empire to see that proper ships and not substitutes are available in future to fulfil the tasks allotted to them. We are all in this. The Navy is as necessary to the Dominions and the Colonies as it is to the mother country, and it should be the common property and practical link of all the nations of the commonwealth, just as His Majesty is the titular head of one and all. Let it not be forgotten that cruisers are necessary to preserve vital communications.

The role of a destroyer is to attack; yet in the Second World War, as in the war of 1914-18, they are largely used for defence. Not defence of themselves but of every other (friendly) surface vessel. No ship, large or small, puts to sea in wartime without a destroyer as a chaperon if one can be found. Unfortunately they are scarce.

In peace time destroyers were not always so popular as in war. Some weeks after the armistice had concluded the war of 1914-18, I was passing a destroyer whose captain had served for many years in that branch of the Navy. He made a signal as we passed: "Now I know the war is really over." I didn't answer, knowing my friend well enough to expect something quite unparliamentary if I asked him why. Meeting him on shore later I did ask him, and he replied: "Well, I passed a battleship at sea, and she made the curt pre-war signal—'Keep out of my way!' "

It is true that battleship captains of the old school had a horror of destroyers; the latter moved fast, cut corners and did all sorts of unorthodox things. And those senior officers felt a little doubtful about the capacity of such junior officers to handle their ships. But those days are

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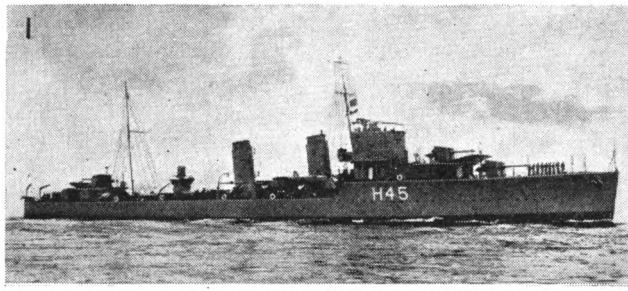
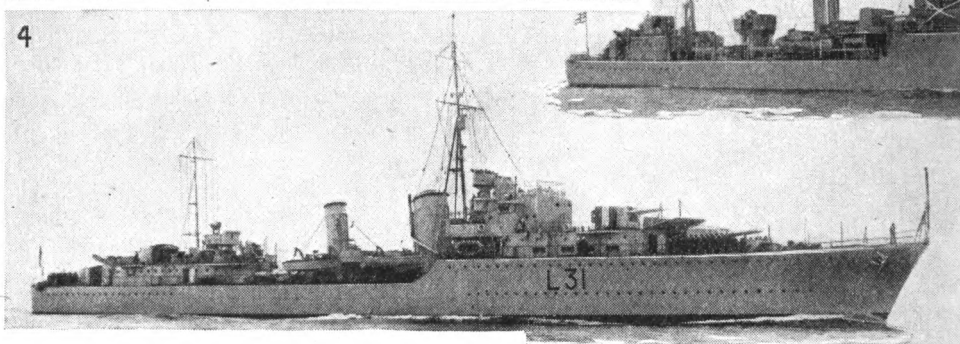
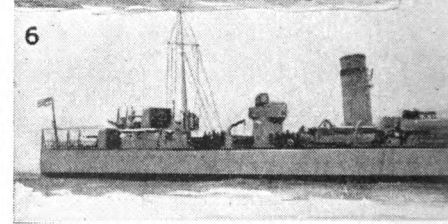
Some of the Destroyers of the Royal







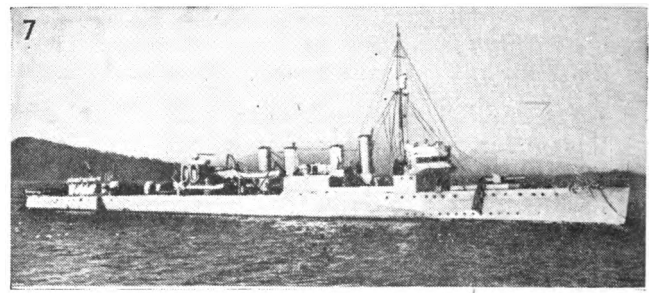
Destroyers are designed to screen battle fleets and act as escorts to protect merchant ships from submarine and surface attack. Apart from their gun and torpedo armament, these fast ships are liberally equipped with depth charges for anti-submarine attack. Fifty American ships (see 7) were exchanged in September, 1940, with Britain for a lease of British Atlantic naval bases.

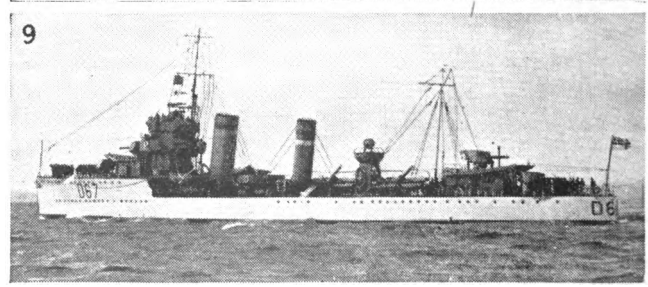
1. "ACASTA" CLASS. *Displacement:* 1,350 tons. *Complement:* 138. *Guns:* Four 4·7-in.; six smaller. *Tubes:* Eight 21-in. on quadruple mounts. *Speed:* Over 35 knots.

2. "HUNT" CLASS. *Displacement:* 904 tons. *Complement:* 120. *Guns:* Four 4-in. A.A.; eight smaller. *Tubes:* None. *Speed:* About 32 knots.

3. "EXMOUTH" CLASS FLOTILLA LEADER. *Displacement:* 1,475 tons. *Complement:* 175. *Guns:* Five 4·7-in.; six smaller. *Tubes:* Eight 21-in. (quadrupled). *Speed:* 36·75 knots.

4. "TRIBAL" CLASS. *Displacement:* 1,870 tons. *Complement:* 190. *Guns:* Eight 4·7-in.; seven smaller. *Tubes:* Four 21-in. *Speed:* 36·5 knots.





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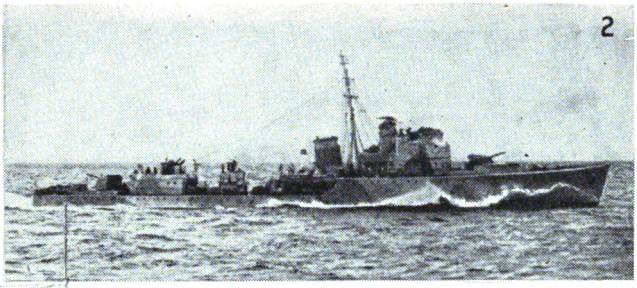
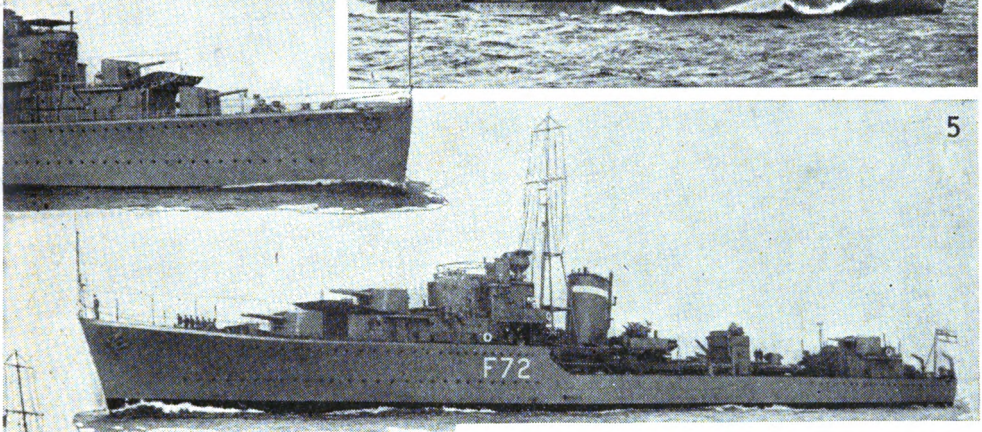
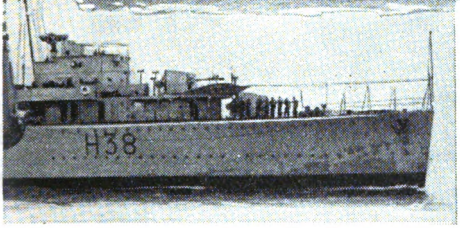
the types used by the Navy

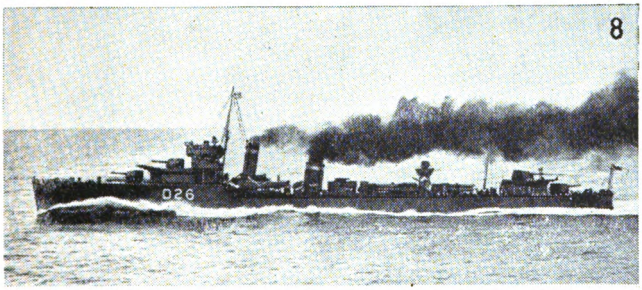






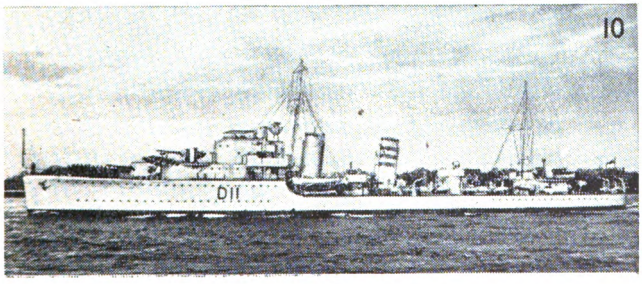
5. "JAVELIN" CLASS. *Displacement:* 1,690 tons. *Complement:* 183. *Guns:* Six 4·7-in.; six smaller. *Tubes:* Ten 21-in. *Speed:* 36 knots.

6. "DEFENDER" CLASS. *Displacement:* 1,375 tons. *Complement:* 145. *Guns:* Four 4·7-in.; six smaller. *Tubes:* Eight 21-in. *Speed:* 36 knots.



7. UNITED STATES DESTROYER. *Displacement:* 1,190 tons. *Complement:* 122. *Guns:* Four 4-in.; one 3-in. A.A. *Tubes:* Twelve 21-in. (tripled). *Speed:* 35 knots.

8. ADMIRALTY W CLASS. *Displacement:* 1,100 tons. *Complement:* 134. *Guns:* Four 4-in.; two 2-pdr. pom-poms; one M.G.; four Lewis. *Tubes:* Six 21-in. on triple mountings. *Speed:* 34 knots.



9. THORNYCROFT MODIFIED W CLASS. *Displacement:* 1,140 tons. *Complement:* 134. *Guns:* Four 4·7-in.; two 2-pdr. pom-poms; one M.G.; four Lewis. *Tubes:* Six 21-in. *Speed:* 35 knots.

10. "INTREPID" CLASS. *Displacement:* 1,370 tons. *Complement:* 145. *Guns:* Four 4·7-in.; six smaller. *Tubes:* Ten 21-in. *Speed:* 36 knots.

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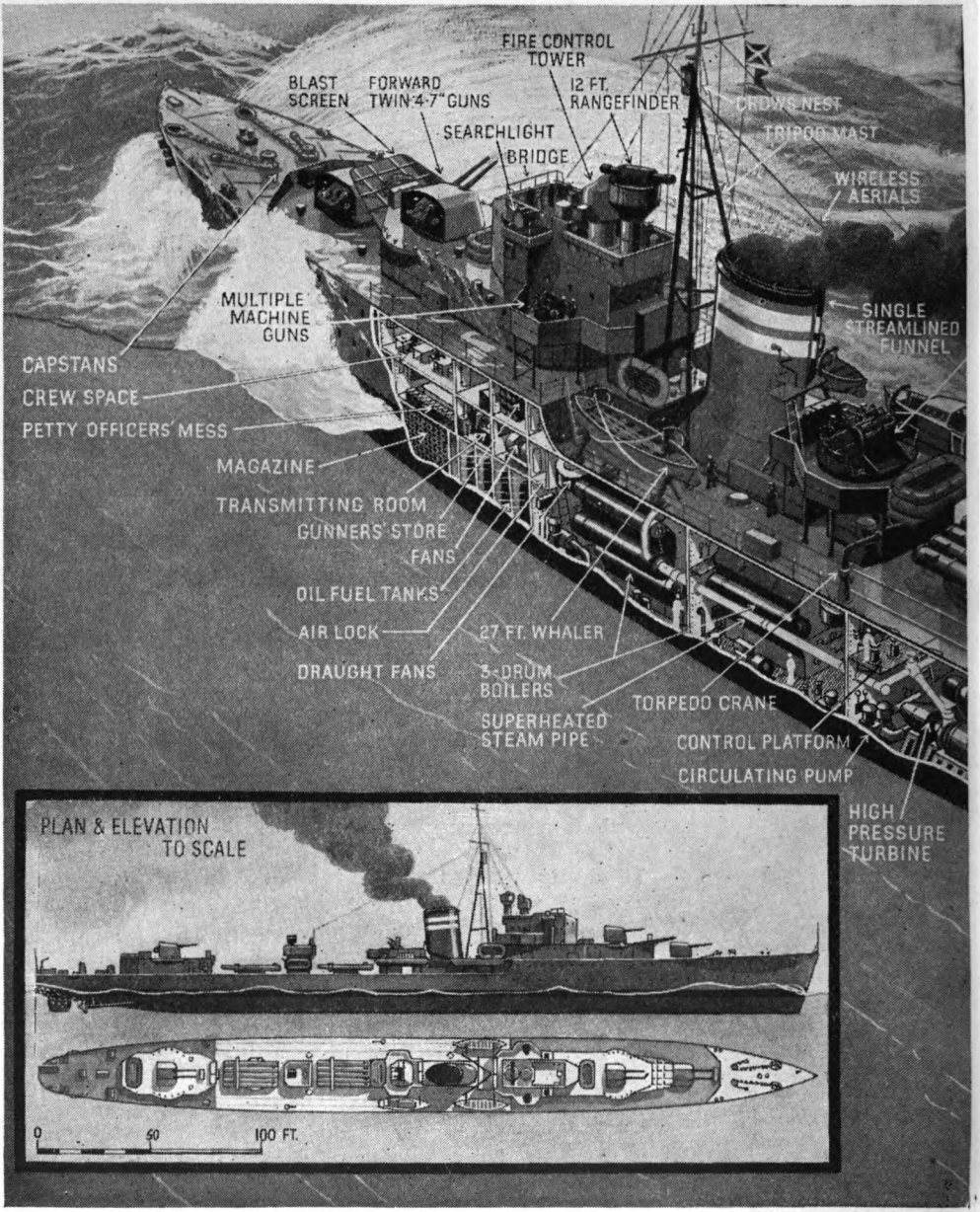

DIAGRAMMATIC DRAWING OF A JAVELIN

These destroyers were the first of their kind, built this century, in the Royal Navy to have a single funnel. They have a very powerful torpedo armament, mounting no less than ten tubes in two sets of five each. The modern method of firing these is by the "ripple" system. By this means the chances of a direct hit on the enemy are increased by the wider area of possible explosion. Six 4.7-in. semi-automatic guns are mounted in three twin turrets; also, one

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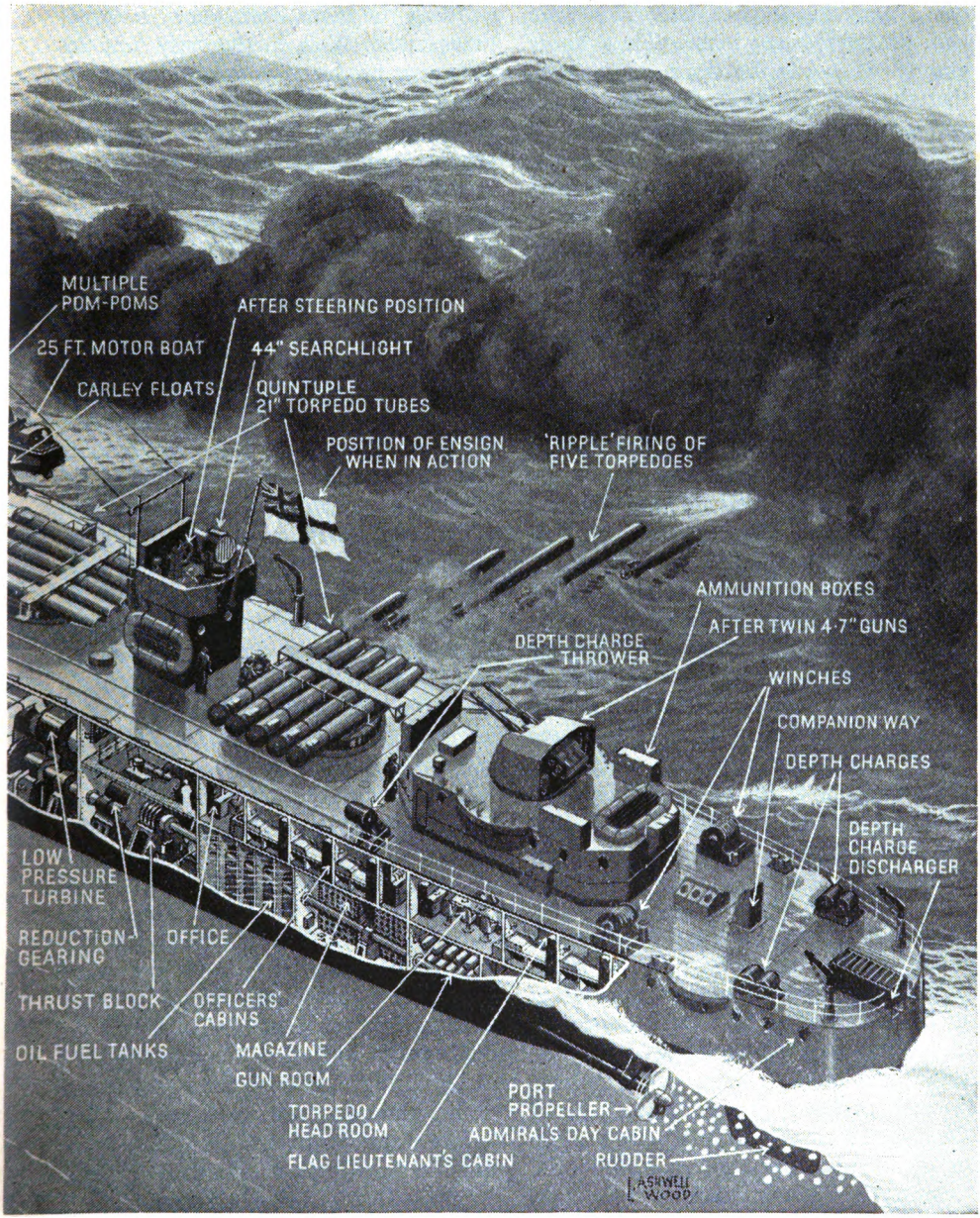

CLASS DESTROYER GOING INTO ACTION

multiple pom-pom for anti-aircraft defence and several smaller guns are carried. The boiler installation consists of two Admiralty three-drum boilers, which supply steam to the 40,000-h.p. geared turbine engines and give a speed of thirty-six knots, or about forty miles per hour. The displacement of these ships is 1,690 tons. They are 348 feet long, have a beam of 35 feet and a mean draught of nine feet. They carry a complement of 183 officers and men

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past. Many big-ship captains now have had destroyer experience. They know exactly what can be done with them, that they are beautiful ships to handle, and that they are beautifully handled and manœuvred.

To put a destroyer alongside a ship in a sea-way, to pick up a boat or a drowning man, eye and exact judgment are required, born of sea experience and knowledge as to what the ship can do. The captain of a destroyer has a unique position to fill. He is not long qualified, his subordinate officers are definitely very junior and in wartime usually diluted by what are known as "hostilities"—enthusiastic young men from every walk of life, hurriedly trained and dubbed sub-lieutenants. Their real training becomes the captain's job.

He has also to get the best out of his crew who likewise are diluted by what the Chinaman so aptly called "makee learns." They are splendid material, but they do throw a weight of responsibility on the captain. At sea he hardly ever leaves the bridge; when he must have some sleep he learns to prop himself up in the chart house and take half an hour's rest at any odd time.

HOVE-TO IN A GALE

Watching from the deck of a ship in a convoy, all hove-to in a gale of wind, it was refreshing to see our watch-dog in the shape of a "W" class destroyer, an old friend of the war of 1914-18, gaily riding the seas and apparently making nothing of them. She was diving down the side of a wave, completely lost to sight in the trough, then up again and over the top of the next, scudding across from one bow to the other, then away astern to look at some straggler, back again, slinging the sea high up over her masthead. You could imagine that she was saying: "Look at me and see how I do it! Why make such fuss about a breeze!"

"Why the name destroyer?" is sometimes asked. Well, in the early 'nineties they were produced as an antidote to the French torpedo boats lying in the harbours on the north coast of France opposite our large naval ports. It was intended that our vessels should hunt down and destroy them, and so remove what in those days constituted a serious danger to our fleet.

A DIFFERENT ROLE

At that time the experiment was being tried of keeping torpedo boats at sea, cruising with the fleet, but it soon became apparent that destroyers could more efficiently perform this duty. This led to the disappearance of the torpedo boat, which reappeared recently in the guise of M.L.s, M.T.B.s, and E-boats. In the meantime the destroyer had taken on quite a different role in the fleet. It had so developed from the original design that it is quite certain the modern destroyer officer would not appreciate being asked to go to sea in one of these early vessels.

They were uncomfortable both for officers and men. Officers lived under conditions that some wag has said encouraged laziness, for the bunks were ranged one over the other around the ward-room table, and on waking you had only to put your feet down and there you were all set for breakfast. Yet they were an improvement in all respects on the torpedo boat, for the torpedo boat had no bridge and was pretty well awash all the time that she was at sea.

The first destroyers, H.M.S. *Havoc* and *Hornet*, were a standard pattern for many years. They had a navigating bridge in the shape of what was known as the "bandstand," a circular platform surrounding the forward 12-pounder gun. It was a light affair of wood with a painted canvas screen, the whole of which was in the habit of folding up like an umbrella

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in bad weather, often leaving the occupant of the bridge clinging to the gun support.

Improvements were made, speed advanced from twenty-one, twenty-five to thirty knots. The thirty-knotter class was a great success, but still very wet at sea. The big change came with the introduction of oil fuel, which gave increased speed and radius of action and effected a saving in weight and space. The next great advance was due to the advent of the submarine menace early in the war of 1914-18. It was then found necessary for every ship of importance to have a destroyer escort, but experience showed that to force a destroyer of the design of the day to keep pace with battle cruisers steaming against a head sea led to considerable damage to the vessel. The answer was to increase greatly their sea-keeping qualities.

The "V" and "W" classes resulted, and are still going strong. They are good ships of a good design, and it might well have paid when we found ourselves so woefully short of destroyers to have given a repeat order for one hundred. For these ships would probably have fulfilled all the requirements of convoy work, especially if the torpedo tubes had been reduced and A.A. guns increased.

CHEAP SUBSTITUTE

However, a ship called a sloop was introduced, a cheap substitute which it was thought could at least fill some of the roles of the destroyer. Sloops lack speed, power, and ability to face a head sea, but they have one great virtue—they are cheap and can be rapidly constructed in time of emergency.

The Second World War has ruled out battle-fleet work on anything approaching the same scale as in the war of 1914-18, so it may seem idle to discuss the handling of destroyers in a fleet action. Yet the organization for attack on surface ships by destroyers in company should not be lost sight of simply because the everyday role of destroyers in this war mainly consists of the attack of and defence against the U-boat.

The outstanding problem, when the enemy had a surface fleet approximating in strength to our own, was to fix him; that is, to prevent him from turning around and making for his base and minefields before contact could be made. Sir David Beatty, as he was then, used to say: "Get me a cripple. Use your speed. Get ahead and attack with torpedoes. If he turns away he will lose ground, and if you can get a hit or two and reduce his speed we can get up to him."

RETIRING ENEMY

To carry out such an operation the destroyers must be as far as possible ahead of the fleet during approach. But there is a limit to such a distance, for it is unwise to uncover the front of the fleet too much before the battle is set.

The torpedo is a weapon that gives the advantage to a retiring enemy and the corresponding disadvantage to the pursuer. Since the speed of the torpedo is not so greatly in excess of the speed of the ship, there is an obvious limit to the positions from which the torpedo can be effectively used.

In practice it is necessary to be well ahead of your target at the moment of firing your torpedo if you are to stand any reasonable chance of hitting. The covering principles for the organization of a flotilla to develop its great power of attack remain the same today as in the past, although present conditions and lack of numbers largely prevent those principles being made use of in practice. The flotilla should be used as a pack, and fought as a pack. It can be divided according to the degree of opposition into half-flotillas, divisions and subdivisions. A flotilla should consist of sixteen ships and a leader, which should ensure, if its

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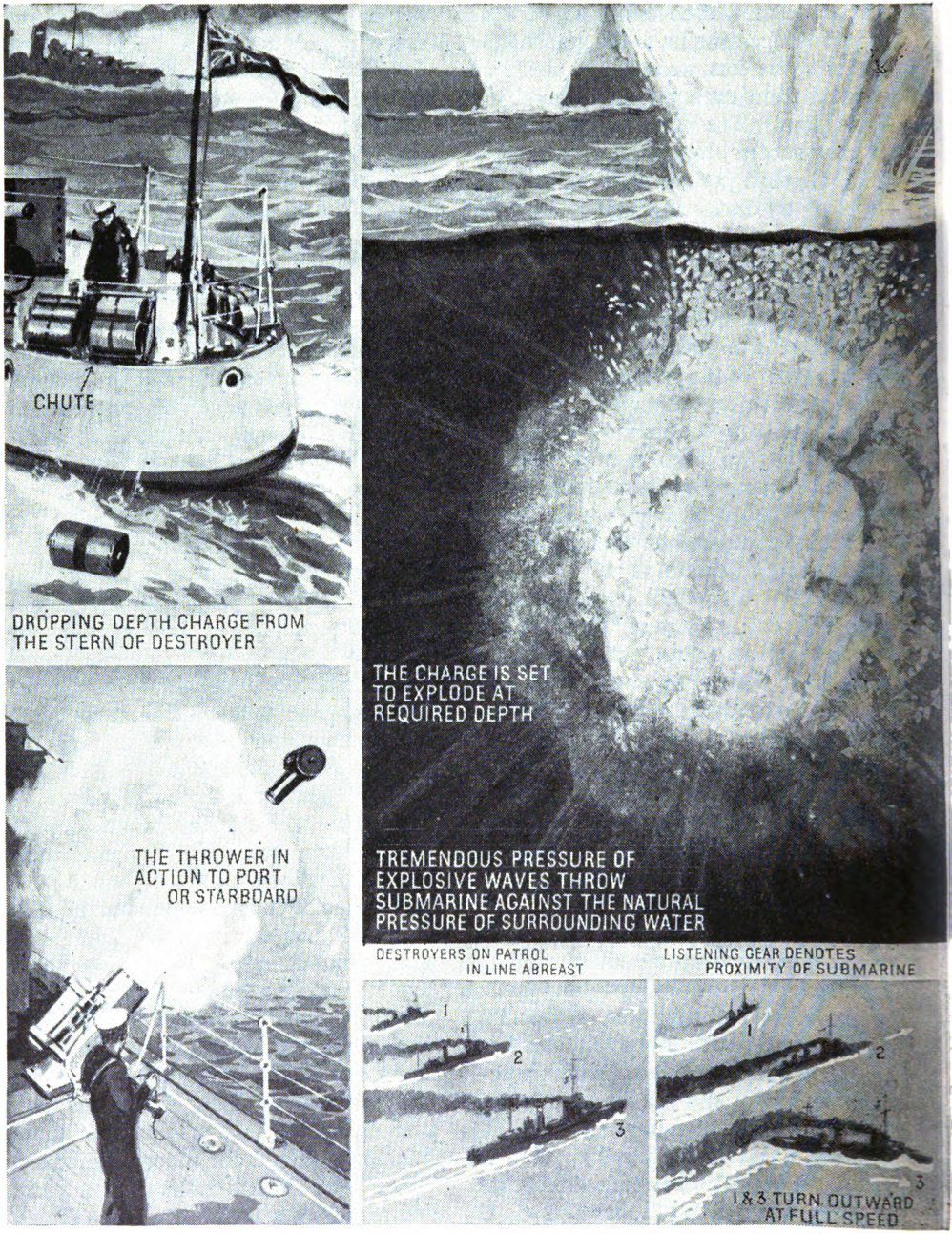
CHUTE
DROPPING DEPTH CHARGE FROM THE STERN OF DESTROYER
THE CHARGE IS SET TO EXPLODE AT REQUIRED DEPTH
THE THROWER IN ACTION TO PORT OR STARBOARD
TREMENDOUS PRESSURE OF EXPLOSIVE WAVES THROW SUBMARINE AGAINST THE NATURAL PRESSURE OF SURROUNDING WATER
DESTROYERS ON PATROL IN LINE ABREAST
LISTENING GEAR DENOTES PROXIMITY OF SUBMARINE
1
2
3
1
2
3
1 & 3 TURN OUTWARD AT FULL SPEED

METHODS OF THROWING DEPTH CHARGES

There are two main methods (left) of dropping the charges, by chute or by thrower. Details of the charge, the chute and the thrower are shown on the right. At the foot of the main drawing are shown the tactics of destroyers when using depth charges. The pressure of the

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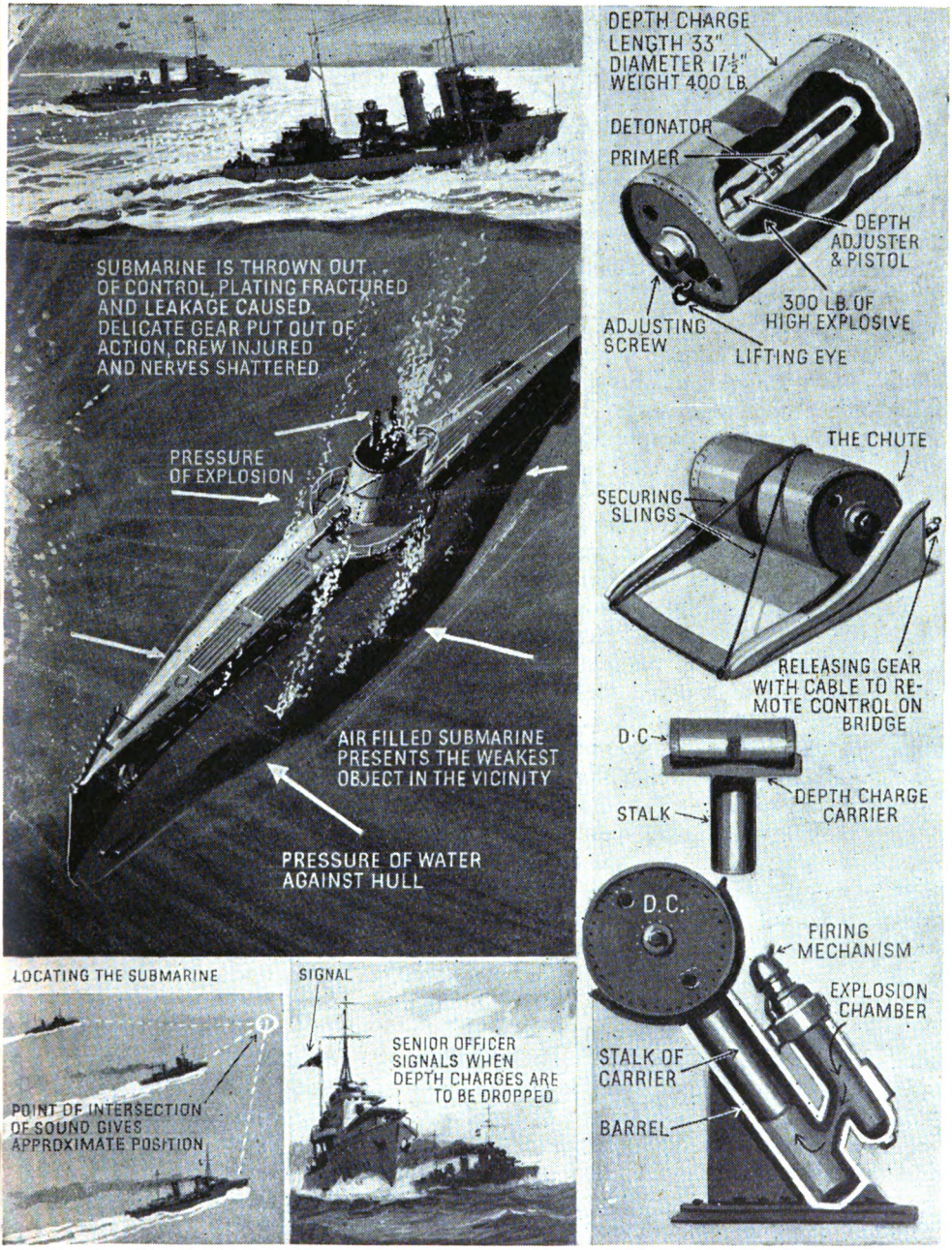
SUBMARINE IS THROWN OUT OF CONTROL, PLATING FRACTURED AND LEAKAGE CAUSED. DELICATE GEAR PUT OUT OF ACTION, CREW INJURED AND NERVES SHATTERED
PRESSURE OF EXPLOSION
AIR FILLED SUBMARINE PRESENTS THE WEAKEST OBJECT IN THE VICINITY
PRESSURE OF WATER AGAINST HULL
DEPTH CHARGE LENGTH 33" DIAMETER 17½" WEIGHT 400 LB.
DETONATOR
PRIMER
DEPTH ADJUSTER & PISTOL
300 LB. OF HIGH EXPLOSIVE
ADJUSTING SCREW
LIFTING EYE
THE CHUTE
SECURING SLINGS
RELEASING GEAR WITH CABLE TO REMOTE CONTROL ON BRIDGE
D·C
STALK
DEPTH CHARGE CARRIER
D.C.
FIRING MECHANISM
EXPLOSION CHAMBER
STALK OF CARRIER
BARREL
LOCATING THE SUBMARINE
POINT OF INTERSECTION OF SOUND GIVES APPROXIMATE POSITION
SIGNAL
SENIOR OFFICER SIGNALS WHEN DEPTH CHARGES ARE TO BE DROPPED

AND TACTICS IN USING THEM

sea, combined with that of the explosion, puts a tremendous strain on the plates of a submarine. Quite apart from the strain on the plates of the submarine, moreover, the effect of heavy and continuous attack with depth charges upon the nerves of the crew is often very serious

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base facilities are good, that twelve ships will always be in good running order.

The leader should be in a specially designed ship, the speed of which should not be less than that of the flotilla in average weather conditions. There should also be room on board for a staff of specialists capable of carrying out running repairs, and advising the captain of the flotilla as to the needs of each department. She would also have more than one wireless room, short range A.T. telephones, and a good plotting room, since it is necessary for the captain of a flotilla to have a plot kept showing every friendly craft within his sphere of operations.

ARMAMENT OF FLOTILLA LEADER

The captain of a destroyer has not the room, the staff, nor the time from his executive functions to keep all this information up to date. Every leader ship should therefore have a full clerical staff to relieve the captains of the destroyers as much as possible of paper work. The leader ship should carry a 6-in. gun armament and a heavy A.A. armament. The latter, perhaps, is the chief requisite. To enable her to carry a full armament of guns, her torpedo tubes could be reduced to a minimum, perhaps one.

The destroyers should be organized in divisions and subdivisions, the divisions being the fighting unit, the four ships of which should never, except under gravest emergencies, be parted. The whole flotilla must know its captain's mind under every condition; this applies even more so in the case of a divisional leader and his division.

Night and thick weather lend themselves to surprise. By surprise, destroyers can get close enough to shorten that all important element—time; time not only of the flight of the torpedo but of the time the target has in which to avoid it.

A night attack by destroyers is a thrilling experience. Even in peace time it entails considerable hazard; vital decisions have to be instantly taken and acted upon. Let us follow our ship through such an attack. An enemy is sighted. "There she is. Hard over. Ease the helm. Steady. Tubes stand by. Fire when the sights come on." All these orders are rapped out in less time than it takes to write, and as the ship swings round on comes the glare of the great searchlights, accompanied in war by the crash of the enemy's guns close at hand. By this time we are steaming full out, blinded by the lights but swinging the ship this way and that to spoil the enemy's gun laying. We are hoping to hear and feel amidst the deafening din the heavy thud of our torpedoes striking squarely home.

The enemy must load and fire with a rapidity that gives little chance for accurate range finding. The speed of his own ship, plus the speed of the attacker's, may be forty or fifty miles an hour, and he has a matter of seconds rather than minutes in which to score hits. As in daylight so at night—the more targets (that is, attackers) that can be presented to the enemy simultaneously the greater the confusion for her gun control, and the more chance of some attackers getting in unscathed to fire their torpedoes.

NEVER-ENDING TOIL

Destroyers in wartime are mostly engaged on convoy work, pushing out to mid-Atlantic or away down south, then leaving outward bound vessels steaming hard away to some rendezvous, in order to pick up a homeward bound lot. Sometimes there is fog, some ice and always, it seems, gales of wind. There may be an attack by U-boats to beat off, or attack from the air. It may be just a there-and-back voyage; a few hours in harbour; a bath, a sleep; fill up with oil and out again. So the life goes on the year round, through long dark nights of winter or the long summer days.

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HUNTING A U-BOAT

The damage done by the tremendous pressure on a submarine's hull of a bursting depth charge sometimes forces the crew to bring her to the surface. This gun crew of a British destroyer in the Atlantic is on the alert in case the enemy should surface within range

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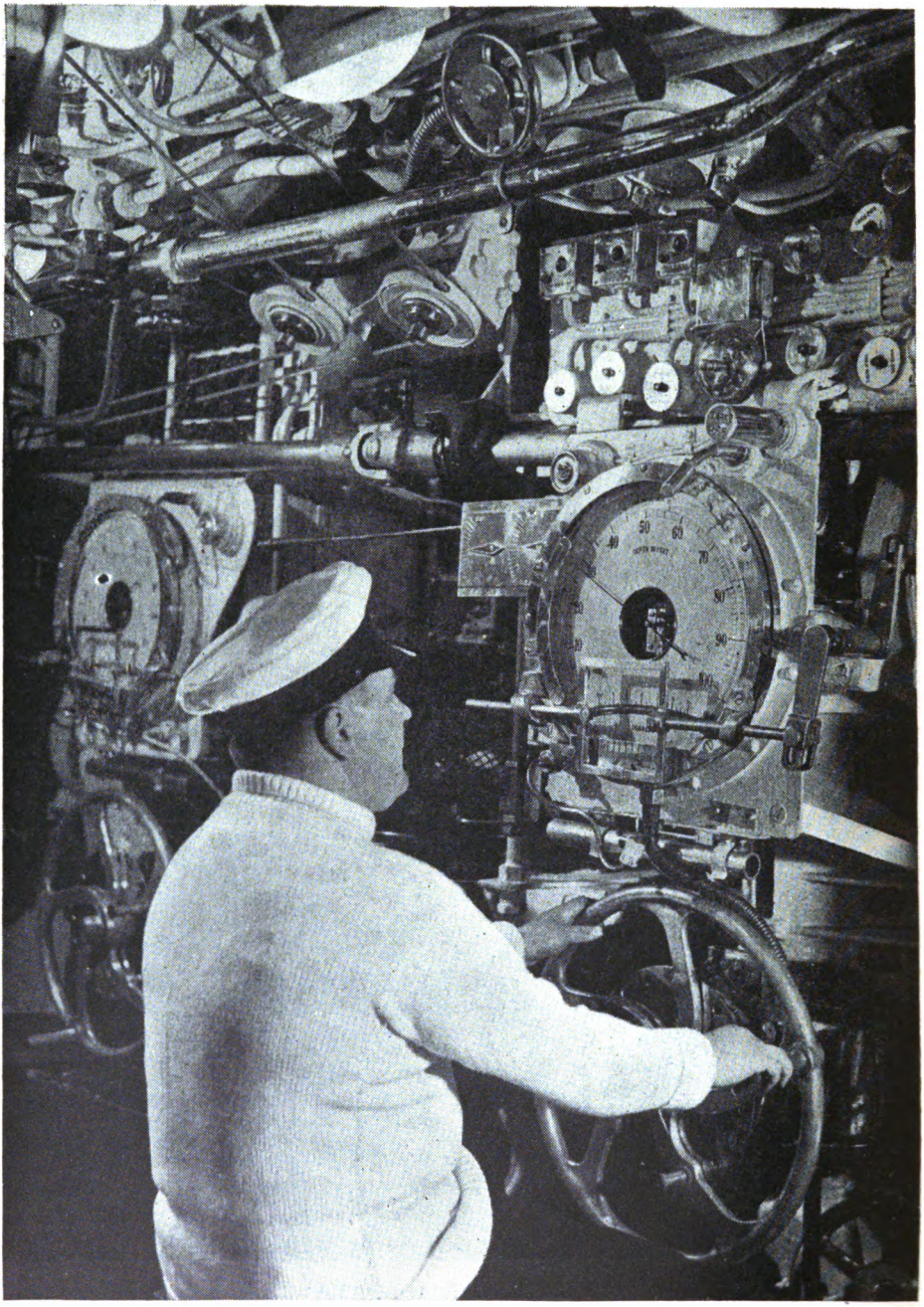

COXSWAIN AT THE WHEEL OF A SUBMARINE

Submarines have two periscopes, used by the captain and the navigating officer. The coxswain carries out the instructions of the latter, thus putting the ship on the desired course

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CHAPTER 9

The Submarine Service

Personnel. Design and construction. Interior arrangements. Living-quarters. Underwater propulsion. Surface motive power. Recharging batteries. Communications. Technique of diving and surfacing. U-boats. Japanese two-man craft. Operations in coastal waters. Methods of attack. Tactics. Triumph of H.M.S. "Truant." Depth charge hunt

THE Royal Navy is called the "Silent Service," and this epithet applies especially to our Submarine Service. It is also the "unseen" service. The reason is obvious, secrecy being vital for successful operations. The commanding officer must possess similar qualifications to the pilot of an aircraft; he must be able to think quickly and make a good decision, he must possess physical fitness to a high degree, and powers of leadership.

He alone is looking through the periscope at the picture before him, and on his judgment depends the success of an attack or the destruction of his ship. Only a small percentage of young men who are available in the Royal Navy fulfil these conditions, and intensive training is necessary before any one of them is capable of commanding a submarine.

COMPLICATED MAZE

After experience has been gained, an officer is selected as first lieutenant. It is a most responsible position. He must see his men are always ready for instant action and his craft for submerging. Every detail must be considered. Every item of the complicated maze of machinery must function perfectly, and it is acknowledged that a submarine is the most "scientific" engine of war that has yet been evolved. A good first lieutenant makes all the difference to the submarine during the few vital seconds when it is crash-diving to safety after sighting an enemy.

Commanding officers of submarines are selected from amongst the first lieutenants, and they undergo further courses before being given a command. So it is seen that they are very valuable and cannot easily be replaced if losses are heavy.

In all theatres of war and in every branch of the fighting services, the advance of science has made the naval profession more difficult, grim and hazardous. This applies in particular to the submarine. The development of two new elements especially hamper operations—the aeroplane and the mine. The first-named is probably the more effective in connexion with the "unseen" factor already referred to. In order to arrive on the scene of her patrol at the appointed time, a submarine must carry out the greater part of her voyage on the surface. She probably cannot afford the time to submerge by day and proceed on the surface by night—she can be sighted even when submerged at periscope depth, unless the sea is rough; and, if sighted, she can be quickly hunted down. There is, also, almost certain to be an aerial patrol guarding the submarine's objective.

The mine must be reckoned with in coastal waters, and is likely to be met with in our own channels, dropped by an aircraft after the sweepers have been through

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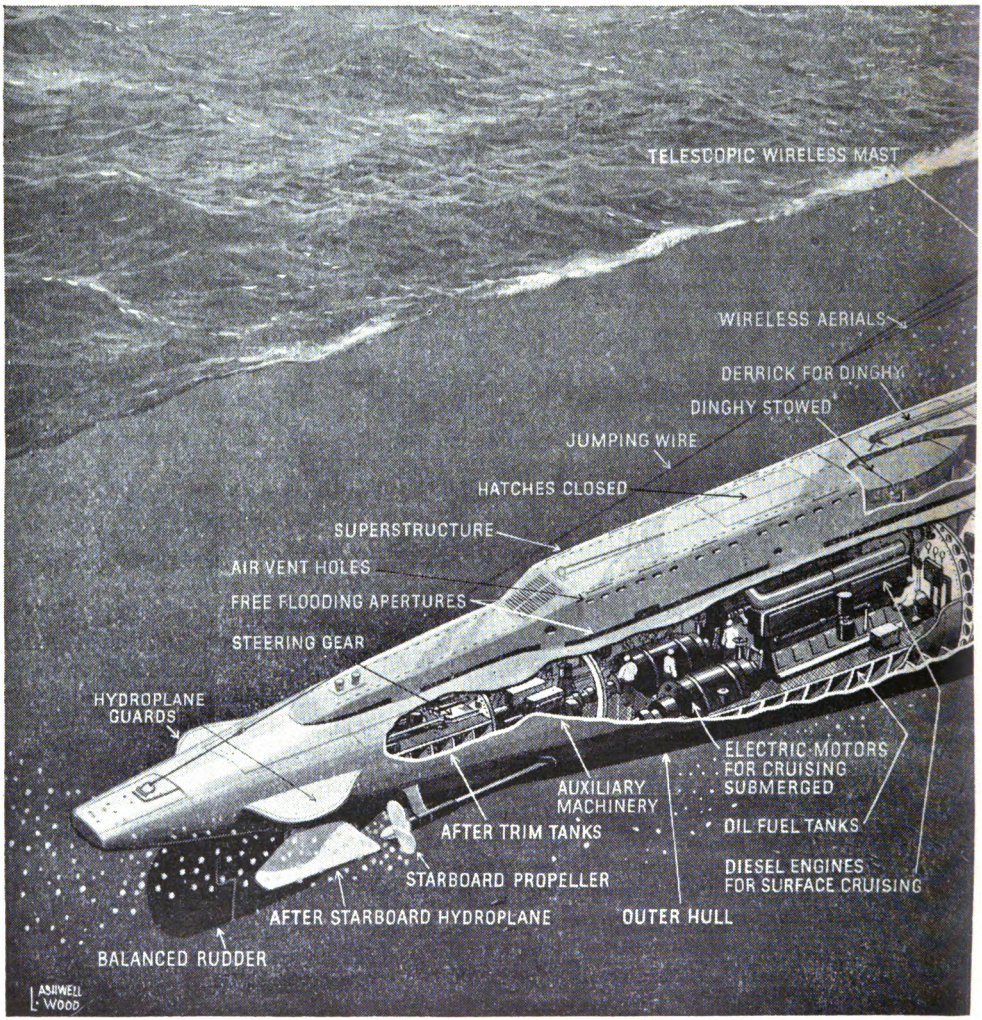
Nevertheless, the command of a submarine is eagerly sought after and is certainly one of the prize jobs in the entire Submarine Service.

The ratings in the Submarine Service are specially selected from volunteers, and there is no lack of suitable men from all branches. In addition to possessing a high standard of intelligence they must be of good character. It is interesting to note that after the war of 1914-18 there was a falling-off of both submarine officers and men, and the Admiralty found it necessary to detail a certain proportion in order to make up deficiencies; but in nearly all cases these volunteered for continuous service when their period of submarine training had been completed.



DIAGRAMMATIC DRAWING OF A

These British submarines of the Triton class are patrol vessels for general service. They are 265 feet long and have a complement of fifty-three officers and men. On the surface, their dis-

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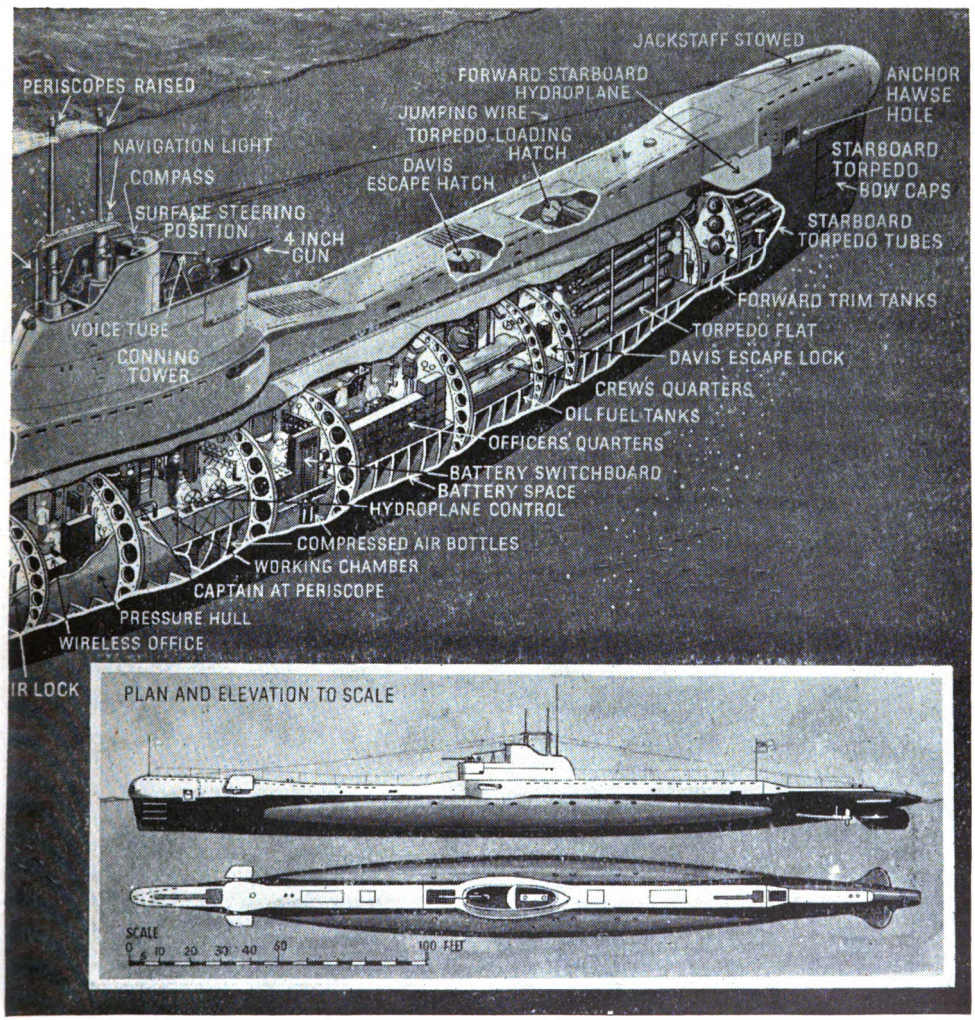
It is comparatively easy for a great nation to turn out large numbers of submarines in wartime, but not trained and experienced personnel. The training and personality of the captain entirely governs the fighting value of the submarine.

It is obvious that the relations between officers and men must be intimate, and the Brotherhood of the Sea becomes closer in a submarine than in any other branch of the Service. Everybody gets to know each other's capabilities, failures and eccentricities; which makes it possible to get the highest output from the whole community. To begin with, a steel tube crammed full of gadgets does not provide ideal living-quarters. The atmosphere often leaves much to be desired after a



SUBMERGED MODERN BRITISH SUBMARINE

placement is 1,095 tons and their speed 15·25 knots; when submerged, the figures are 1,579 tons and nine knots respectively. They carry at least six 21-in. torpedo tubes together with a 4-in. gun

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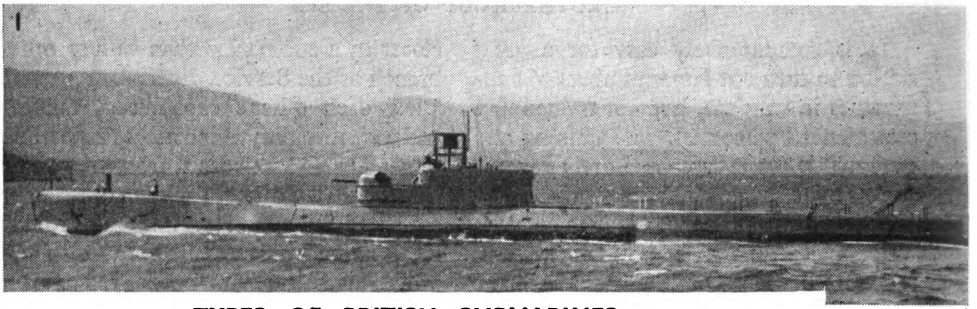


TYPES OF BRITISH SUBMARINES

Submarines are divided into three main types: ocean-going, sea-going and coastal. Displacement and speed change when the ship is submerged. Representatives of each type are shown here.

1. "THAMES" CLASS (ocean-going). *Displacement:* 1,850/2,723 tons. *Complement:* 60. *Dimensions:* 325×28×13 ft. *Guns:* one 4-in., two machine guns. *Tubes:* six 21-in. (bow). *Speed:* 10 knots submerged, 22·25 knots on surface.

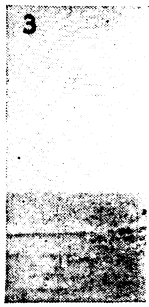
2. "UNITY" CLASS (coastal type). *Displacement:* 540/730 tons. *Complement:* 27. *Dimensions:* 180×16×12¾ ft. *Guns:* one small. *Tubes:* six 21-in. *Speed:* 10 knots submerged, 11·25 knots on surface.

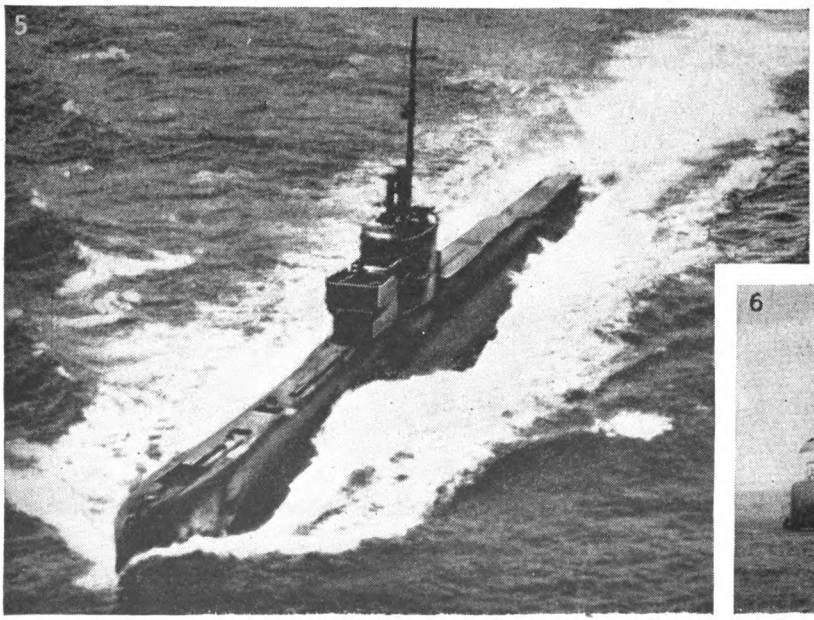
3. "SHARK" CLASS (sea-going). *Displacement:* 670/960 tons. *Complement:* 40. *Dimensions:* 202×24×10⅛ ft. *Guns:* one 3-in., one machine gun. *Tubes:* six 21-in. (bow). *Speed:* 10 knots submerged, 15 knots on surface.

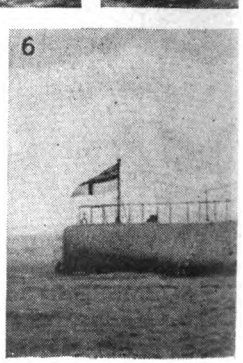
4. "PARTHIAN" CLASS (ocean-going). *Displacement:* 1,475/2,040 tons. *Complement:* 50. *Dimensions:* 260×28×13⅜ ft. *Guns:* one 4-in., two small. *Tubes:* eight 21-in. *Speed:* 9 knots submerged, 17·5 knots on surface.

5. "TRITON" CLASS (ocean-going). *Displacement:* 1,090/1,575 tons. *Complement:* 53. *Dimensions:* 265×26½×12 ft. *Guns:* one 4-in., two smaller. *Tubes:* ten 21-in. *Speed:* 9 knots submerged, 15·25 knots on surface.

6. "PORPOISE" CLASS (ocean-going minelayers). *Displacement:* 1,520/2,157 tons. *Complement:* 55. *Dimensions:* 271½×25½×15 ft. *Guns:* one 4-in., two machine guns. *Tubes:* six 21-in. (bow). *Speed:* 8·75 knots submerged, 15·75 knots on surface







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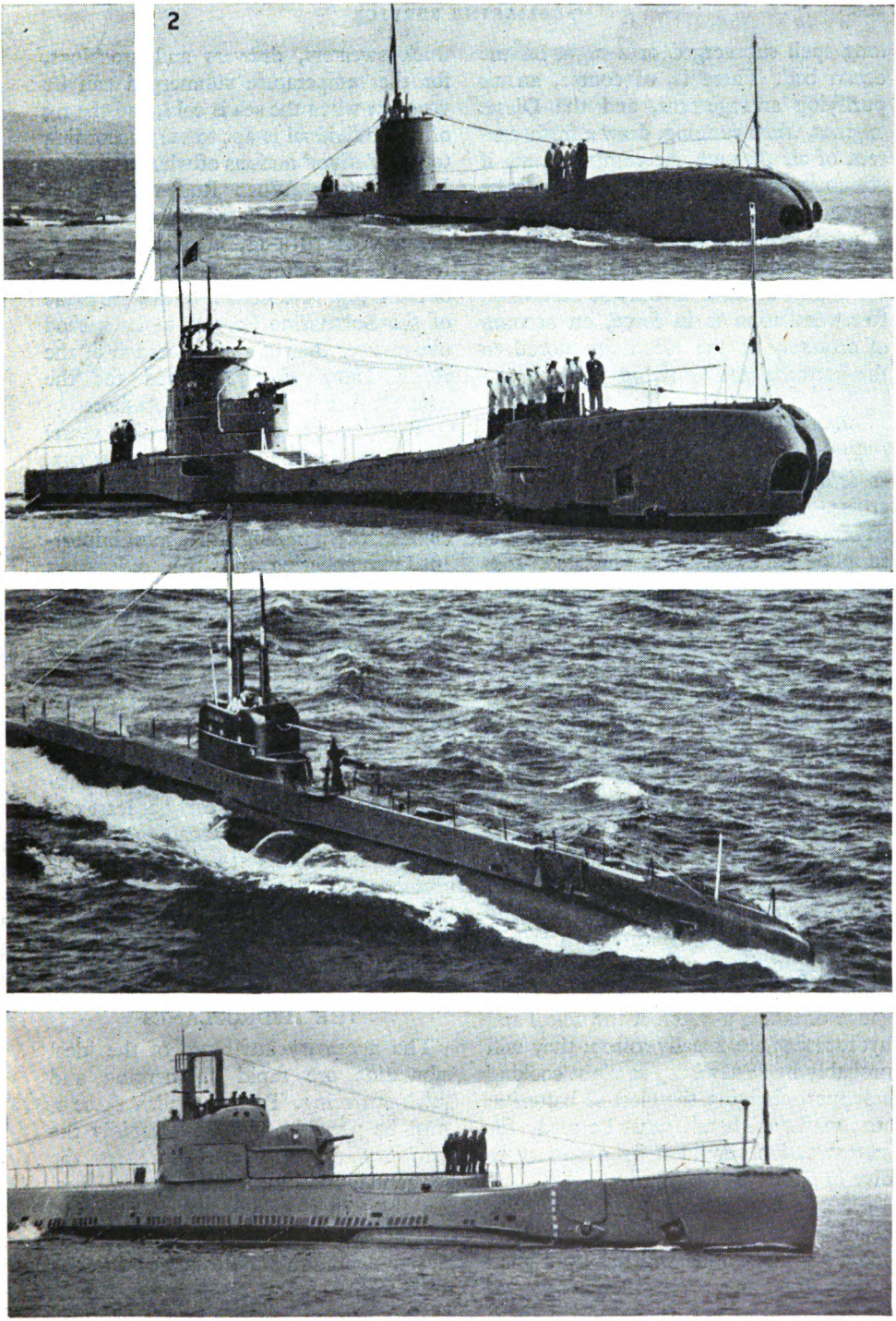

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long spell submerged or a night on the ocean bed. There is, of course, an air purifying arrangement, and the Diesel engines, when running, draw a fresh current of air through the compartments if circumstances permit a ventilator to be opened in the fore part of the vessel. Water is precious, so very little washing is possible. Cooking and heating are done by electricity, which must only be used when free ventilation is in force, on account of economy of the electricity stored in the batteries and to reduce odours.

COMFORT AND RECREATION

Tinned and bottled food is consumed, as fresh provisions soon run out on a cruise. Despite these restrictions the feeding is good and the extra "comforts" supplied are especially appreciated. It is necessary to diet carefully in hot climates, drink one's fill at breakfast and only gargle with lime-juice and water during the day if prickly heat is to be avoided.

Every possible facility is provided for the comfort and recreation of officers and men in the depot ship when circumstances permit a submarine to lie alongside her. The depot ship is fitted out with workshops, and carries a large staff to deal with any repairs that are too big to be undertaken by the crew of a submarine. There is very little time for games and recreation when a submarine is at sea. In the daytime, if the vessel is submerged, those of the crew who are not watching a gauge or taking a watch at the wheel and hydroplanes are usually asleep; they will probably be pretty busy at night cooking a supper, charging the electric batteries, etc., whilst all hands must be ready for instant action should it be necessary to dive in a hurry.

Despite this strenuous existence the health of the personnel remains extremely good, and the flotilla will put up a good rugger or soccer team when resting at the base. Every one is served out with thick sweaters, drawers and stockings, for the temperature submerged can be very low when the sea is cold, and the rig of the individual is apt to vary according to his relatives' notions of what is nice for Jack to wear. When Rudyard Kipling visited the famous Harwich flotilla during the war of 1914-18, he afterwards referred to the submariners as "Scarecrows of the Deep." Nevertheless, it is the pride of the Submarine Service to be turned out smarter than any other branch of the Royal Navy when "cleaned for the beach," that is, dressed to go ashore.

The designer of a submersible vessel must keep in mind several vital factors, perhaps the most essential being strength to resist heavy pressure and explosive charges. Streamlining also is most important, remembering that the underwater motive power is derived from electric batteries, and therefore the power available to propel the submarine below water is urgently rationed. And the word "unseen" must not be forgotten, this necessitating a small silhouette on the surface. These are not as easy to attain as may appear at first sight, because the submarine has probably to carry at least one gun, which must be capable of being manned in a rough sea. There must be protection for the officer on watch and a look-out, provision for periscope standards, wireless telegraphy masts for long-distance signalling, and other gadgets.

THE HYDROPLANES

The necessary attributes of the ideal submarine are rapid submerging and quick surfacing. To accomplish these it must be possible to destroy rapidly the buoyancy of the vessel so that the horizontal rudders, called hydroplanes, can force her below the surface and control her at the depth required. The reverse operation is necessary in order to come to the surface rapidly; water must be blown from the tanks in order to gain

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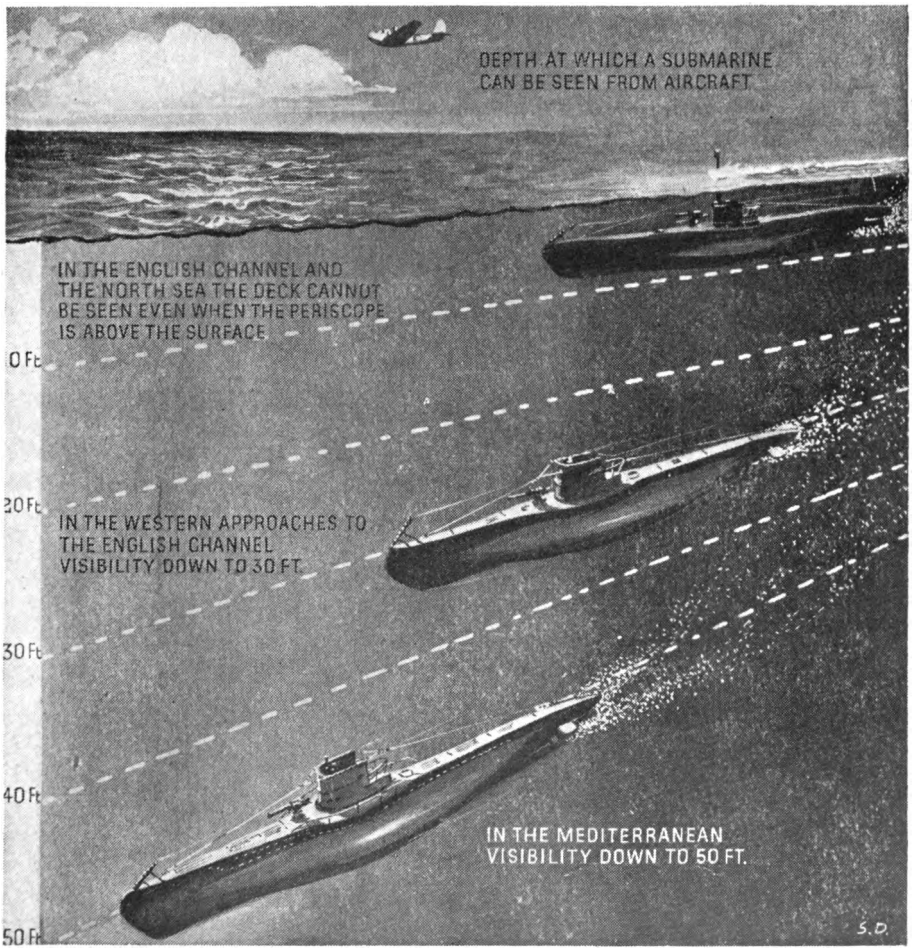
buoyancy. This is done by compressed air, stored in steel bottles in the hull.

A submarine has two hulls or shells, subdivided into compartments to provide tanks for flooding, for carrying oil fuel and fresh water. The "pressure hull" of a submarine is usually made of about ½-in. plating and is, where possible, circular in section.

In very early designs this pressure hull formed the outer shell, but as submarines gradually increased in size it was found impossible to carry sufficiently large tanks to submerge; so that the inner skin became the pressure hull and the main tanks were carried externally, only auxiliary tanks for finer adjustments of trim, storage of batteries, etc., being carried internally. Very large Kingston valves in external tanks are always open to the sea to equalize pressure on the thin outer skin when the submarine is submerged.


DEPTH AT WHICH A SUBMARINE CAN BE SEEN FROM AIRCRAFT
IN THE ENGLISH CHANNEL AND THE NORTH SEA THE DECK CANNOT BE SEEN EVEN WHEN THE PERISCOPE IS ABOVE THE SURFACE
0 Ft
20 Ft
IN THE WESTERN APPROACHES TO THE ENGLISH CHANNEL VISIBILITY DOWN TO 30 FT.
30 Ft
40 Ft
IN THE MEDITERRANEAN VISIBILITY DOWN TO 50 FT.
50 Ft
S.D.

VISIBILITY OF A SUBMARINE FROM THE AIR

Such visibility varies with the sea surface, the type of sea bed, the depth of water, the intensity of the daylight and the height of the aircraft. Depths in different areas are here shown

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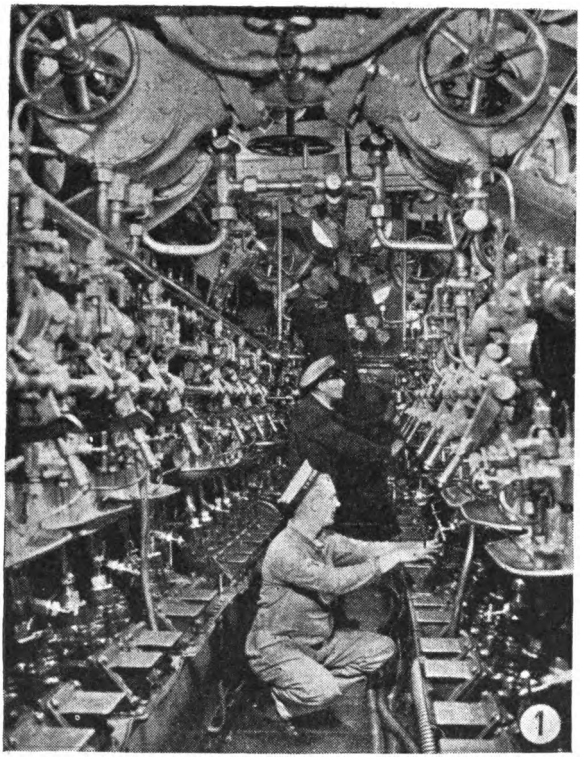

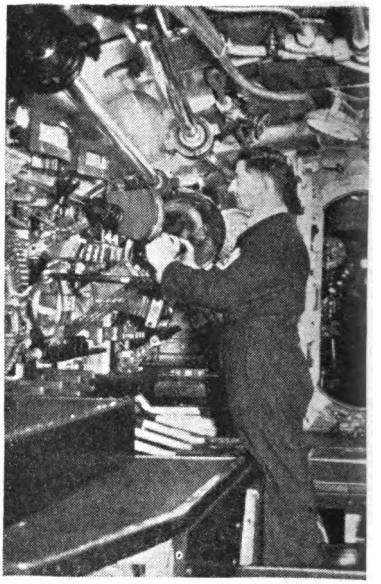

INTERIOR COMPART-

1, Main engine-room, showing Diesel engines which propel the ship when on the surface; **2,** electric motor control-room—the electric motors are used when the submarine is sub-

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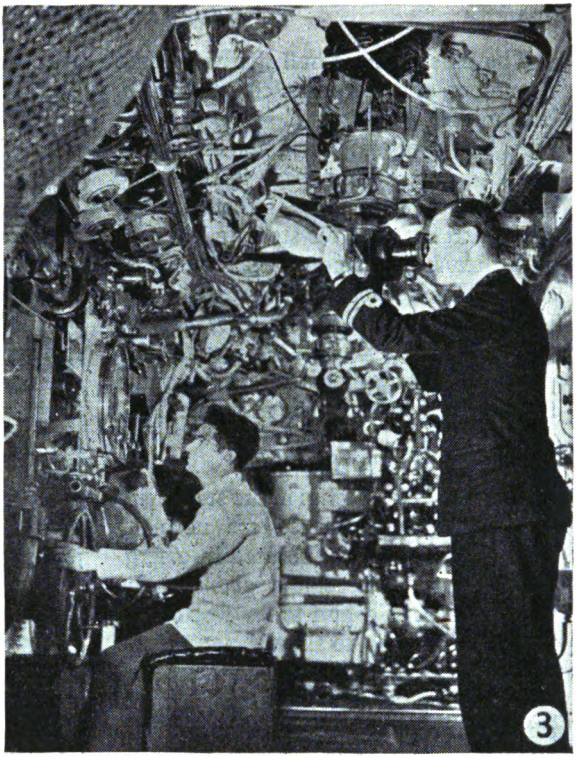
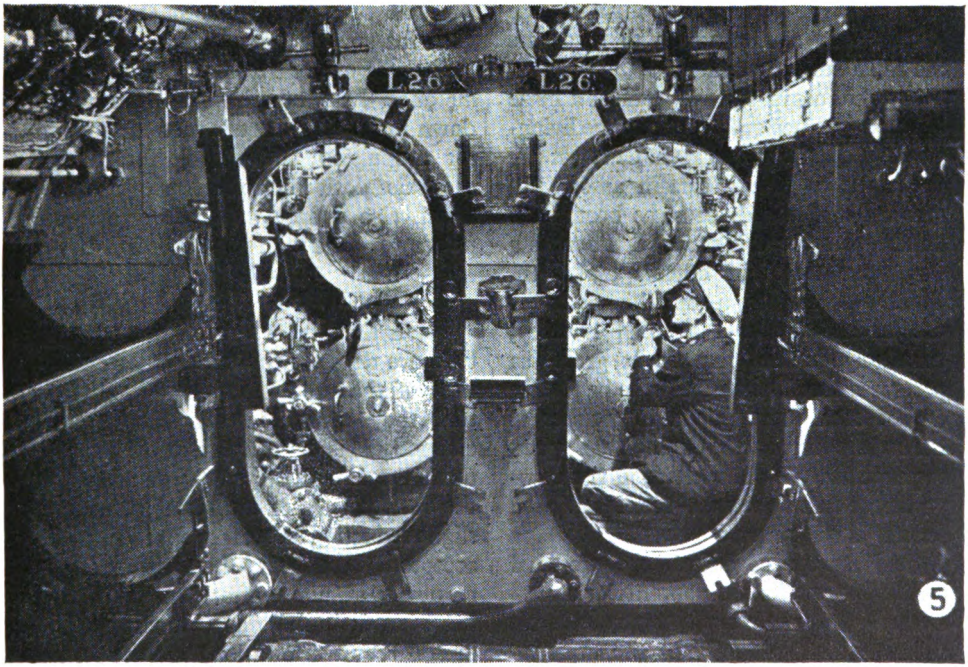


MENTS OF A SUBMARINE

merged ; **3,** commander at periscope and coxswain operating the hydroplanes which control the ship's depth; **4,** crew's quarters; **5,** fore compartment, showing the four forward torpedo tubes



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The inner skin or hull is divided into a number of water-tight compartments. The middle one, situated below the conning tower or sea hatch, is called the control-room. This space is the nerve centre of the submarine. It contains the wheel and compass for steering, the fore and after hydroplane wheels, the periscopes, the electrically operated pistols for firing the torpedoes, switches for working the motors, the plot of the course and positions, arrangements for blowing and flooding tanks, and other instruments.

TORPEDO TUBES

There are big hatches in the submarine forward and aft. These are normally closed at sea, but can be used in emergency if it is necessary to abandon the vessel. There is a gun tower just before the conning tower, to allow the gun crews to man the gun rapidly for surface action.

The foremost watertight compartment carries the nest of torpedo tubes, and the after compartment the stern tubes. Just forward of the latter are the main electric motors, and connected on to these are the main surface engines.

In other compartments, amidst a maze of valves, gauges and pipes, are the living-quarters of officers and men. Curtains can be drawn to give a certain amount of privacy, if required. In some boats light bulkheads serve this purpose. There is a tiny wash-place for officers and men, which will just take a small hip-bath, for use in harbour, and a small lavatory, cunningly devised for use at great sea pressures should the submarine be resting on the ocean bed. A certain number of bunks are fitted, to be lowered when required for use. The settee in the compartment called the ward-room is utilized for the same purpose.

Cold storage cupboards are provided for fresh provisions. In another compartment is the wireless telegraphy cabinet, and a "silent cabinet" for the listening gear. A Davis escape apparatus is supplied in each compartment containing an exit hatch, sufficient helmets being supplied for the entire ship's company. There is also an air purifying system.

One of the first submersible vessels was the invention of a monk. It held two men and was propelled by an oar. But the submarine did not become a practical proposition until the advent of the internal combustion engine, which has altered all methods of modern warfare. Early types were fitted with petrol engines. Obvious objections to the use of petrol were the dangerous fumes it gave off in a confined space and the more dangerous gases from the engine if the joints happened to leak.

Directly the Diesel (or heavy oil) engine was invented it was employed in submarines. A form of steam engine was successfully tried out in the French Navy and subsequently during the war of 1914-18, in order to gain surface speed. The Diesel, however, is the method adopted by all countries at the present time for surface propulsion.

Because of the necessity of conserving air once the submarine has been closed down for diving, electric motors are used for propulsion. The power for driving these is derived from large batteries, which also supply the lighting and the power for all auxiliary purposes.

UNDERWATER ENDURANCE

Upon the life of the charge of these batteries depends the underwater endurance of the submarine, so it is obvious that they must be always kept fully charged. This is normally carried out by using the main motors as dynamos when the surface engines are running, when a slight reduction in surface speed must be accepted. If a heavy battery charge is required, at night after the submarine has been diving all day (provided she is in her required position) the propellers

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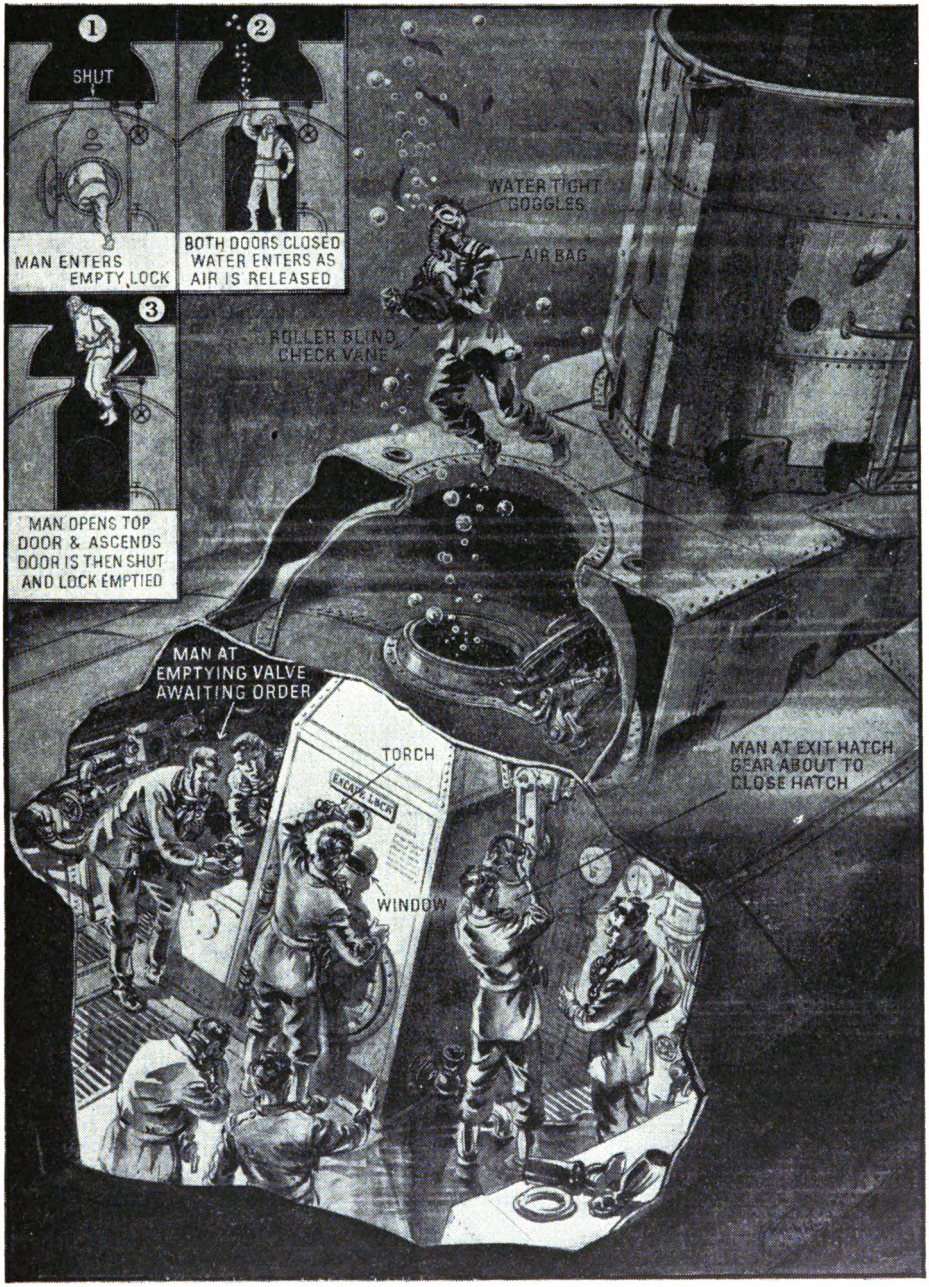

THE DAVIS ESCAPE APPARATUS FOR SUBMARINES

This apparatus enables men to escape from a disabled submarine. The insets show the various stages of such an escape. Compressed air empties the escape lock after each man has left it

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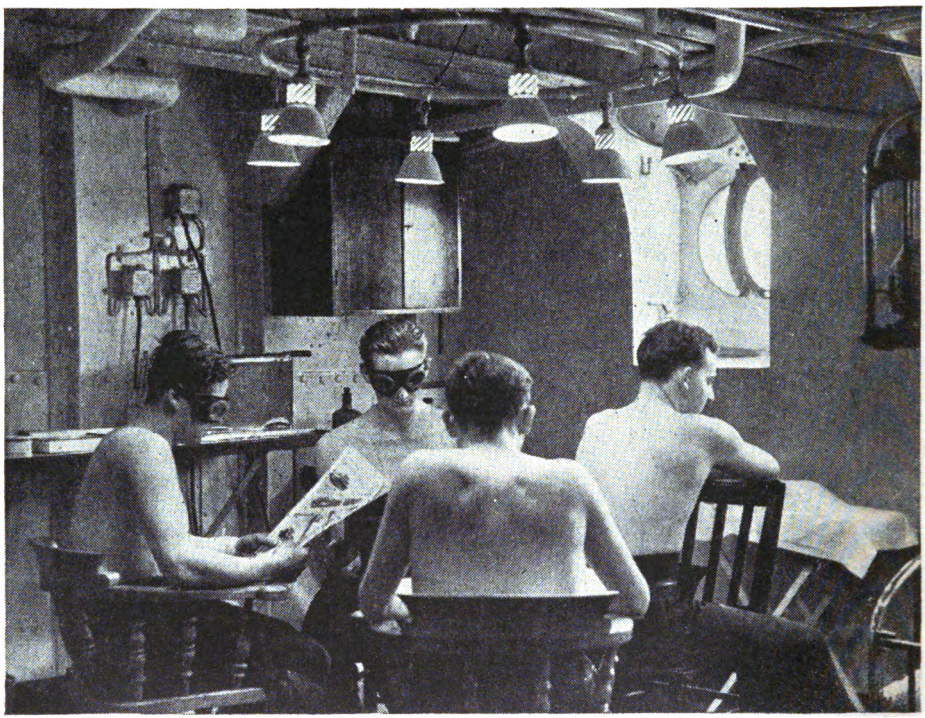
can be disconnected by a clutch to free them from the shaft, and the surface engine used to revolve the motors, the boat remaining stationary. There is, of course, a clutch between the main motors and surface engines.

During the last twenty years, vast strides have been made in sound signalling and listening gear, the latter being particularly useful to a submarine that is being hunted. As the hunter is sure to possess some device of the same kind, much experience and cunning are required to lay him a false scent.

It can be easily understood that a magnetic compass is of very little use, even if placed above the conning tower, as it must be affected by the many auxiliary motors, etc., in the submarine. With the introduction of the electric compass this handicap was eliminated. The electric compass is also used for the plotting table, where an accurate plot is kept of the many alterations of course when the submarine is submerged. The captain must rely on getting his actual position by taking star sights at night with a sextant, as it is seldom possible to use the sun by day for this purpose—unless the submarine is proceeding on the surface to her patrol position.

For convenience in harbour, if it is required to shift berth, or in emergency, the main motors of a submarine can be instantly utilized. When proceeding to sea the powerful surface heavy oil engines are clutched up, and the patrol submarine can remain on its beat for about one



SUBMARINE CREW HAVING SUN-RAY TREATMENT

Life on submarines is one of stress and strain; fitness is essential. When crews return to their depot ship, they stretch their legs and tone themselves up with sun-ray treatment

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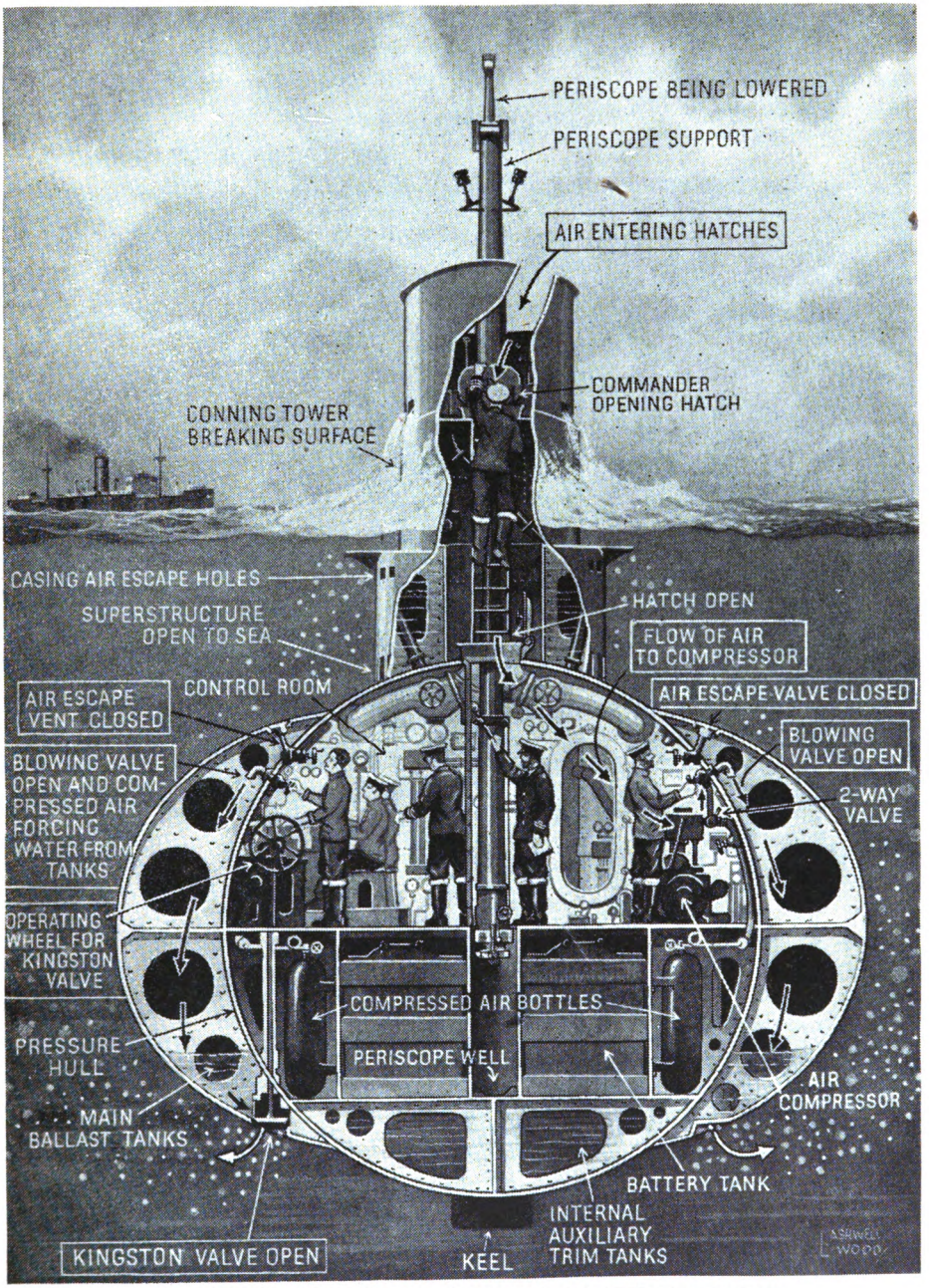

A BRITISH SUBMARINE COMING TO THE SURFACE

When a submarine dives, water is admitted to the ballast tanks to destroy her buoyancy. When it surfaces, the Kingston valves are opened and compressed air from bottles is admitted through the blowing valves. This forces the water out through the bottom of the tanks

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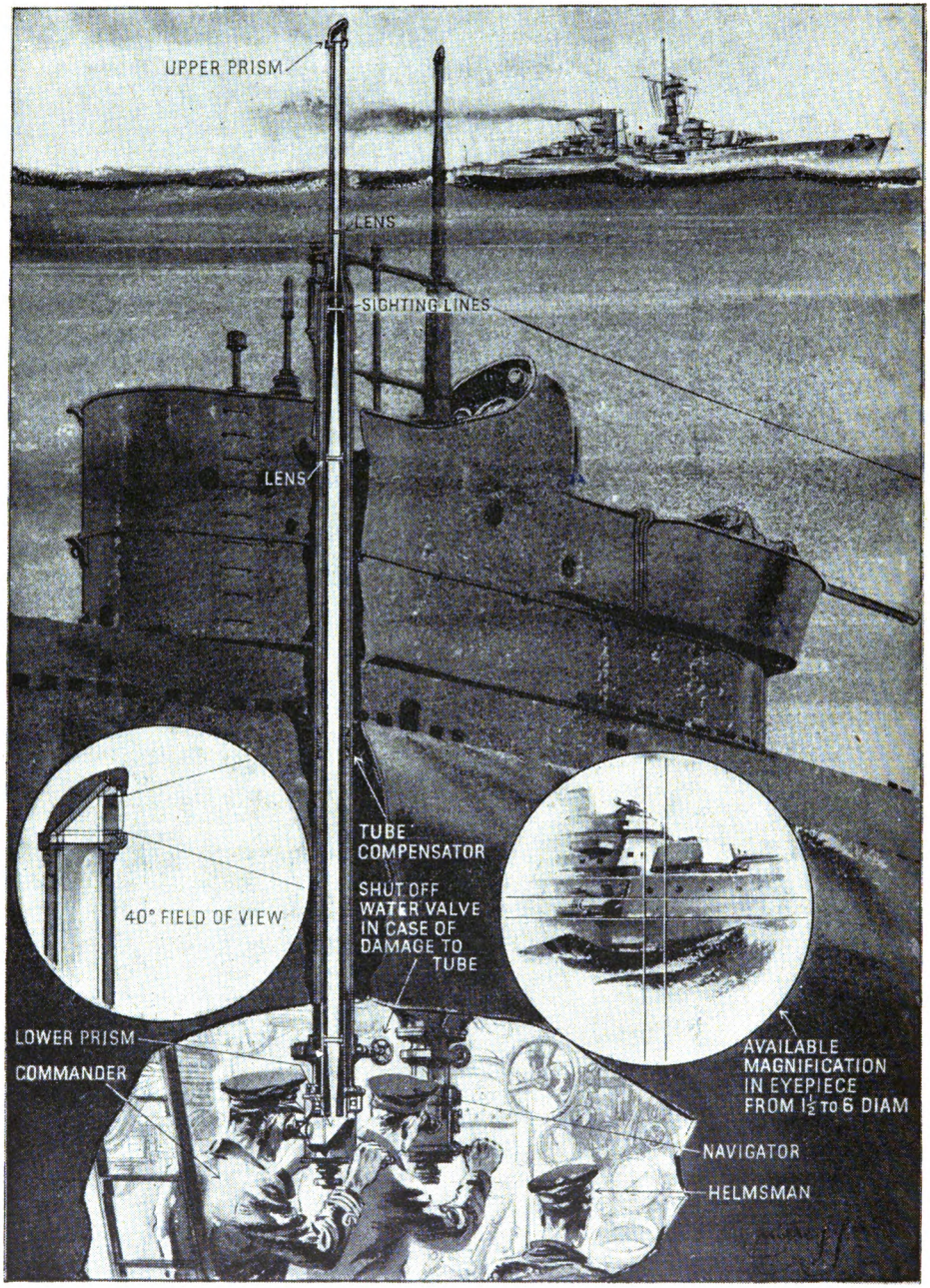

THE EYES OF A SUBMERGED SUBMARINE

Submarines have two periscopes, one for the commander and one for the navigating officer. When two feet above the surface, the periscope gives a visibility of about 3,000 yards. Lenses reflect images and sighting lines enable targets to be centred for the firing position

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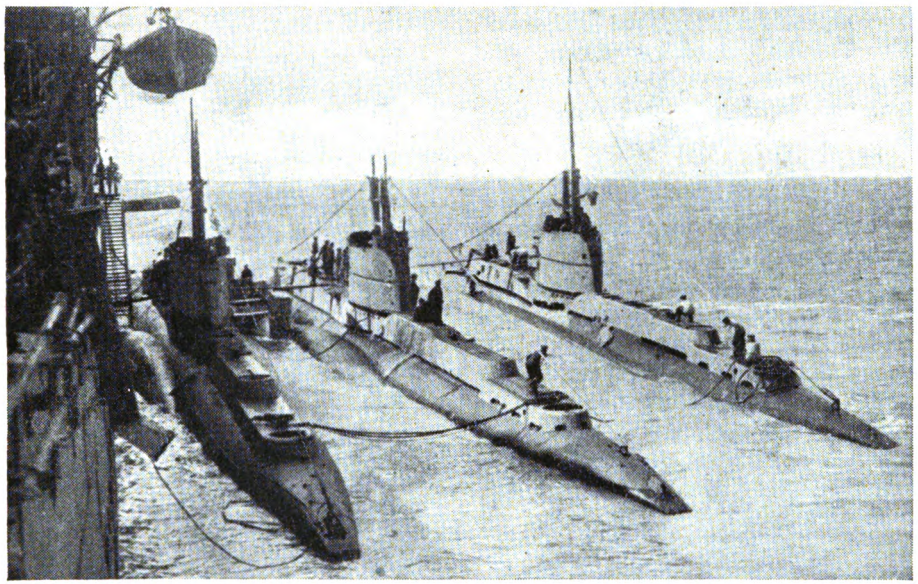
month, 1,000 miles from its base. Probably during this period the conning tower "lid," and possibly the gun tower, which are capable of being instantly closed, are the sole methods of ingress and egress. The average enemy submarine has a surface speed of sixteen knots.

Care is necessary in foul weather, when the seas are coming over green and the conning tower hatch is closed, not to shut the ventilators in error if perhaps a sea comes down them. The surface engines use an immense amount of air and a partial vacuum would thus be created, and the air become sufficiently rarefied to be most unpleasant.

When preparing to dive it is necessary to destroy the buoyancy of the vessel by opening the vents on the main tanks, in order that the hydroplanes situated at the bow and stern can control her; at the same time the surface engines are shut off, declutched, and the main electric motors are started at full speed. A well-trained crew will dive a submarine from full buoyancy in under one minute, and if she is in war trim, that is, with the tanks partially filled, in less than half a minute. All fine adjustments are made before the submarine proceeds on a cruise, if necessary an initial dive being made.

Fuel, etc., is compensated for by water as it is expended. There is a tank fitted at each end of the submarine, so that water can be blown by compressed air to either end to correct rapidly the angle of trim, should this be altered by the effects of a depth charge or any such reason.

To dive rapidly it is only necessary for the submarine to take up an angle of one or two degrees down by the bow, which is corrected on attaining the required depth, so that she becomes horizontal with slight positive buoyancy. The speed of the motors is then reduced, and with the hydroplanes the vessel is held at the required depth. If the trim attained is good a submarine can patrol on one motor.



BRITISH SUBMARINES BESIDE THEIR DEPOT SHIP

These submarines have returned from sea to their depot ship. Here the crews rest while the engines and batteries are overhauled and the tanks are refuelled. These ships are of the Shark class

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When so delicately balanced, care must be exercised not to move personnel or weights carelessly about the boat.

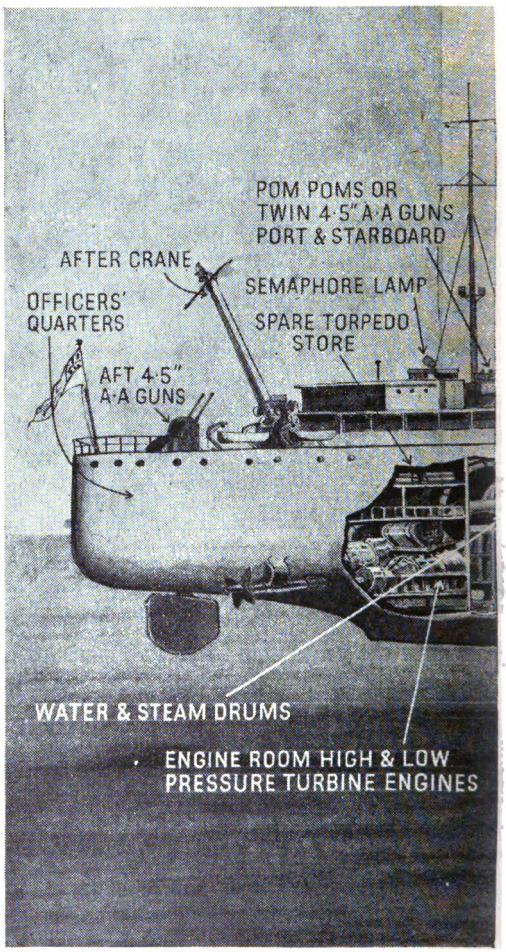
In the war of 1914-18 the enemy had a "drill" for keeping the bow down if he was depth charged. It was called "holding down stations." On the given order, all spare numbers would hurl themselves head foremost through the round doors in the watertight bulkheads, causing the boat to dip smartly by the head and back again when they had accomplished their object. Two English submarine officers, who were prisoners in a U-boat, saw this evolution performed when a British destroyer was depth charging her.

BATTERY ECONOMY

Every possible precaution is needed to maintain maximum economy in the use of the batteries, which may be required to produce high speed in an attack or to evade the hunting destroyers later. The average submarine can maintain a maximum speed of ten knots submerged for over an hour, and two knots for over thirty-six hours, provided the battery is well charged on diving. She must then come to the surface and recharge the batteries, which is normally done during darkness, as she is less visible and therefore less vulnerable. After long submersion the crew will be rather exhausted through lack of oxygen. These two factors, exhaustion of the battery and lack of oxygen, govern the length of time a submarine can remain submerged.

A submarine can dive from between 200 to 400 feet without danger of constructional damage. Should the captain desire to see what is happening on the surface, or in the air, the submarine is kept at periscope depth, which enables him to raise a periscope to the required height above the sea level. He can then take a look round and, if he wishes, take his bearings, afterwards lowering the periscope again into its well in the boat.

It is not infrequently required to "surface" rapidly, possibly to use a gun on an unsuspecting enemy. To accomplish this, compressed air is used to blow the main ballast tanks until the submarine has surfaced and the conning tower lid is open; then a low pressure generator is put on to the tanks in order to conserve the compressed air, the surface engines are clutched up and the submarine proceeds on the surface again in a matter of minutes. After a long dive it is



EQUIPMENT, STORES AND

The floating base of submarines is their depot ship. This is a specially designed workshop,

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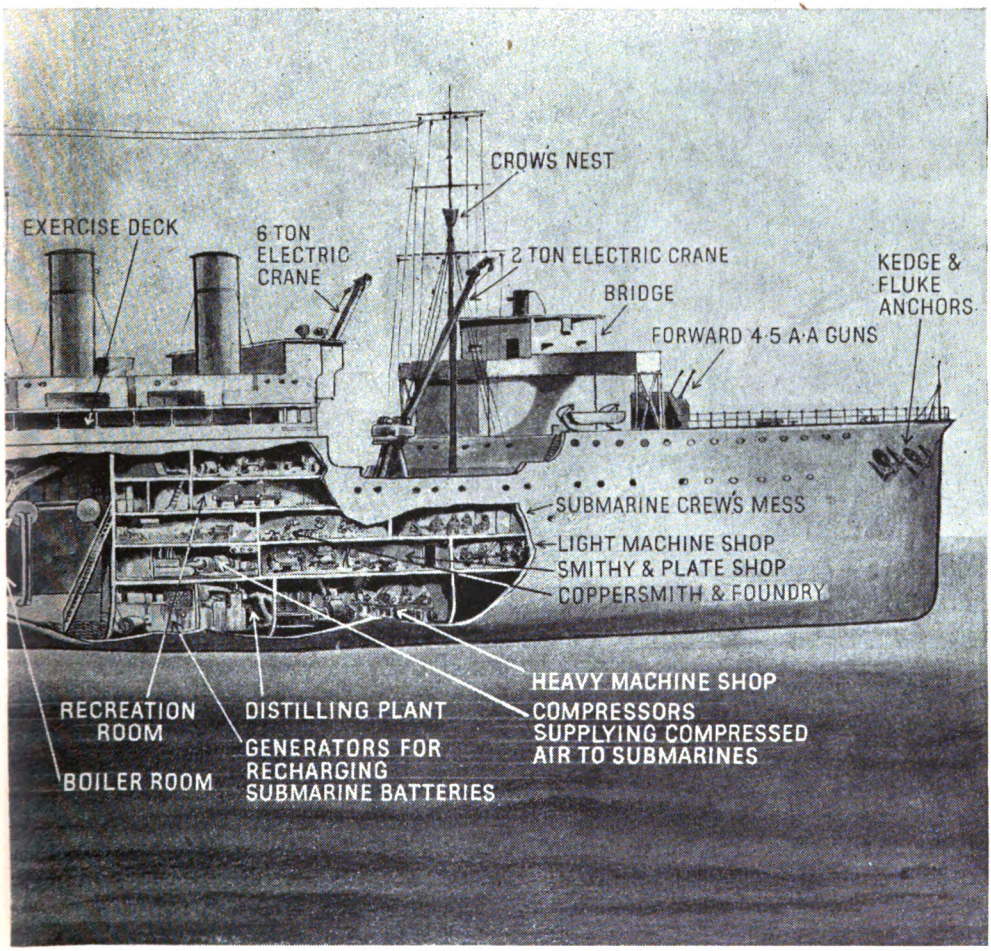
necessary to equalize pressure as far as possible before opening the conning tower lid, as air is certain to have leaked from the reservoir.

If a pressure of air has accumulated owing to this cause, a thick fog is generated in the boat when a hatch is opened and the pressure suddenly reduced. The air no longer can keep the moisture absorbed and the fog results. Cases have occurred of the captain being blown bodily through the hatch by opening up too quickly, together with any loose gear left in the conning tower.

Germany builds smaller ocean-going patrol and mine laying submarines than our own, but her bigger boats have very good endurance and are well arranged internally. Some have a surface displacement of 750 tons. A U-boat of 500 tons surface displacement and a speed of eighteen knots well armed is capable of submerging to a great depth. There is also a small U-boat of 300-ton surface



ARMAMENT OF A SUBMARINE DEPOT SHIP

store and rest ship. Batteries are here recharged, damage repaired, fuel tanks refilled and the crew fed and rested. The ship has storage space for torpedoes and cranes for handling them

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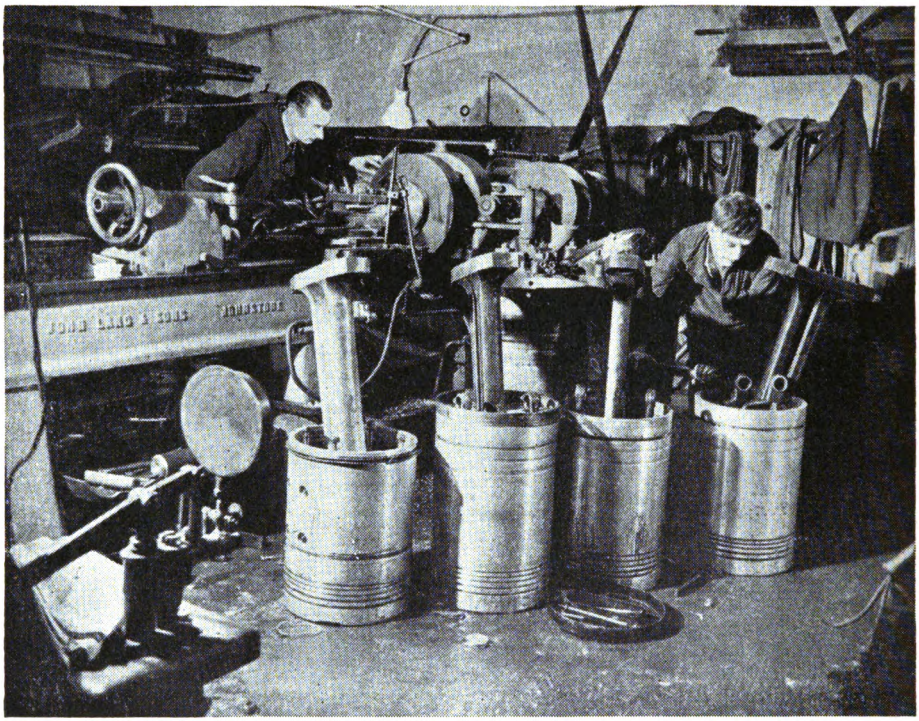
displacement of a coastal type with a surface speed of thirteen knots and with three officers and twenty-four men.

Japan has copied the submarines of other nations. It was revealed in the attacks on Pearl Harbour that Japan built a small submarine carrying a complement of two (one officer, one man), a type of "suicide" submarine to be released outside an enemy harbour. It is propelled by electric batteries and carries two torpedoes and a 300-lb. explosive charge in the bow, so that the whole vessel can be utilized as a torpedo. It is said to have a 200-mile cruising range, and a speed of twenty-four knots for a short period.

The enormous progress in the development of aircraft, and the advances in devices to destroy a submerged submarine, have made operations in coastal waters increasingly difficult and dangerous. Whereas the German Zeppelins and airships were tiresome factors in a limited area in the war of 1914-18, the aerial patrols under present conditions which can appear at a speed of 300 to 400 miles per hour out of a cloud are a constant menace to the submarine. Aircraft can drop mines in coastal waters and harbours during dark hours after the channels have been swept. These mines may detonate on contact, by magnetic influence or by acoustics (that is, sound), and a submarine is particularly susceptible to these hazards.

The explosive force of the depth charge and of the torpedo has been greatly increased, and high-speed anti-submarine craft escorted by aircraft constantly patrol the North Sea and Channel.



SUBMARINE ENGINES BEING OVERHAULED

On returning to their depot ships, submarines often have an engine overhaul. Here are seen the pistons of the engine being cleaned and checked in the well-appointed workshop of a depot ship

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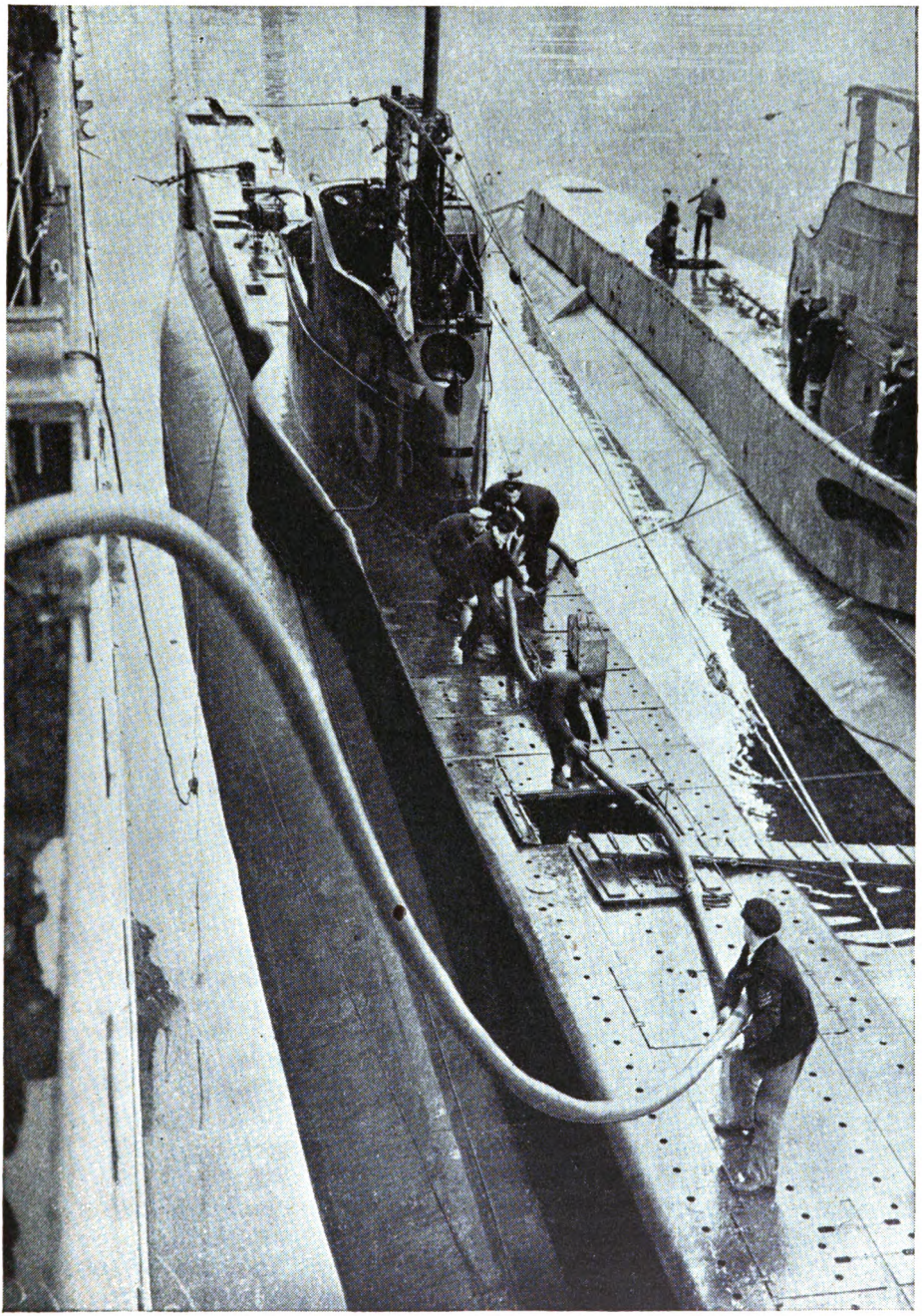

A SUBMARINE BEING REFUELLED FROM THE DEPOT SHIP

The time a submarine can remain submerged depends on the capacity of her batteries; her radius of action depends upon the amount of fuel carried. Here fuel tanks are being filled

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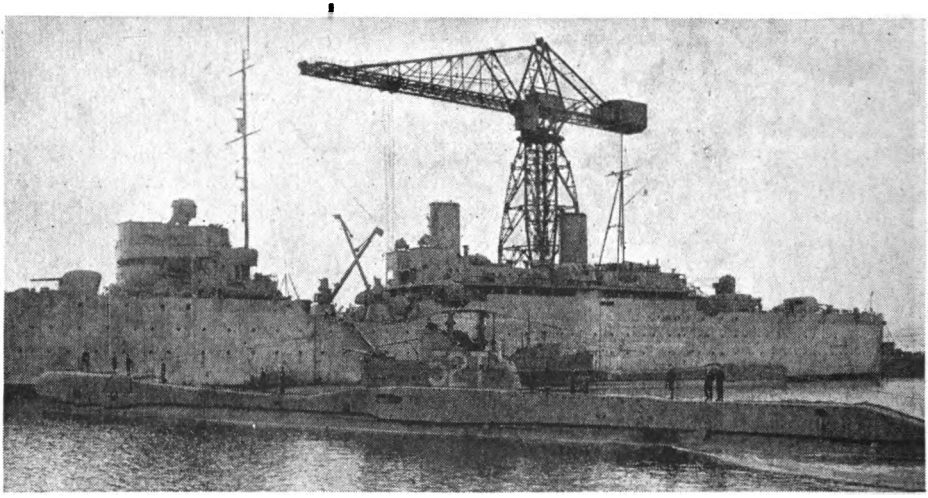
If a squadron or a convoy is escorted by aircraft in addition to escort vessels, an attack is very difficult to press home on a calm day, and extremely hazardous afterwards even for the most experienced commanding officer.

A submarine is largely dependent on the early information she receives by wireless telegraphy and aerial patrols, to get into a favourable position in order to intercept her quarry. Her mobility is limited, and as she is probably submerged by day in her patrol area, her radius of action is small. The distance a vessel can be sighted through a periscope under fair conditions is some five or six miles, and the captain can only afford to take a quick peep every few minutes, in case the enemy are escorted by aircraft. So he does not get very long in which to determine what are the enemy's mean course of advance and speed. If it is a fast moving squadron, an element of luck must come into the problem.

In addition, if he is to make certain of a hit he should come in to within 800 yards of his target before firing his salvo of torpedoes. Another point to remember is that the submarine must move slowly, about two to three knots, if the feather made by the periscope is to remain unseen and if she is not to be picked up on some listening device. Again, the submarine has a large turning circle. The enemy is probably zigzagging; there may be an outer and a close screen of escort vessels, and the submarine will, of course, have to pass through some of these if it is going to fire torpedoes at close range.



SUBMARINE RETURNING TO HER DEPOT SHIP

The unusual silhouette of a submarine's parent ship is clearly seen here. There is plenty of space below deck for repair shops and storage. A submarine is seen returning from patrol

Immediately the torpedoes are fired the submarine must endeavour to escape the hunt, which may be expected immediately in the form of depth charges. The effects of these are frightening; lights may be extinguished in the boat, the trim may be upset, structural damage may be caused. If a depth charge detonates within fifty feet this may prove fatal. Both the hunters and the submarine are listening for all they are worth; noise must be reduced to a minimum, and great cunning employed to mislead the enemy.

A story in this connexion concerns the sinking of the German cruiser *Karlsruhe*.

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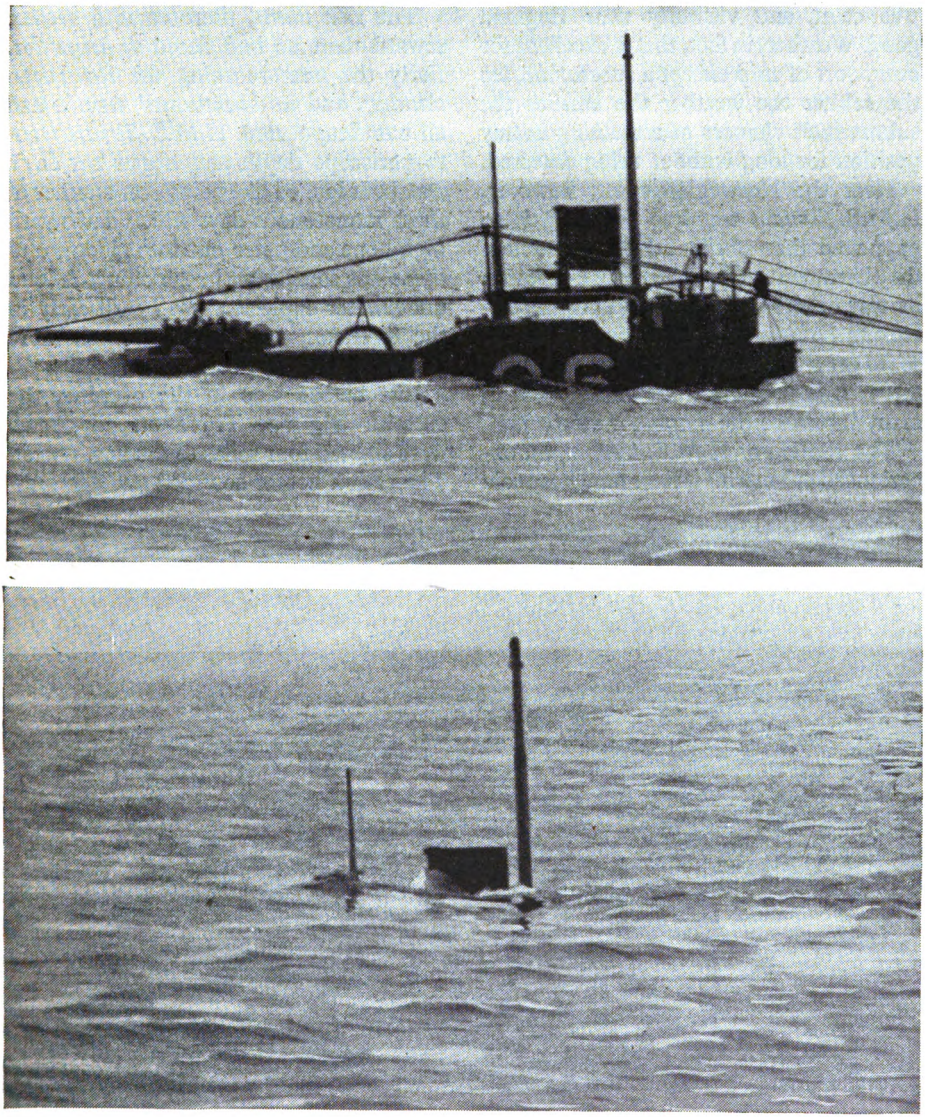
It was the submarine H.M.S. *Truant's* first success against another warship, and was a splendid beginning to a long and distinguished career. The attack was followed by a depth charge hunt by a German destroyer lasting five hours, during which time some hundreds of charges were dropped. The British submarine and her company emerged from this ordeal shaken but unscathed, their



A BRITISH SUBMARINE SUBMERGING

Older types of submarine, such as the L.36 seen above in the two stages of submersion, are used for training purposes. A well-trained crew can completely submerge their ship in sixty seconds. Team work is essential. The success of an attack is dependent on the skill of the captain

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only complaint being against the scorekeeper, who lost count of the depth charges dropped and thus ruined a very promising sweepstake.

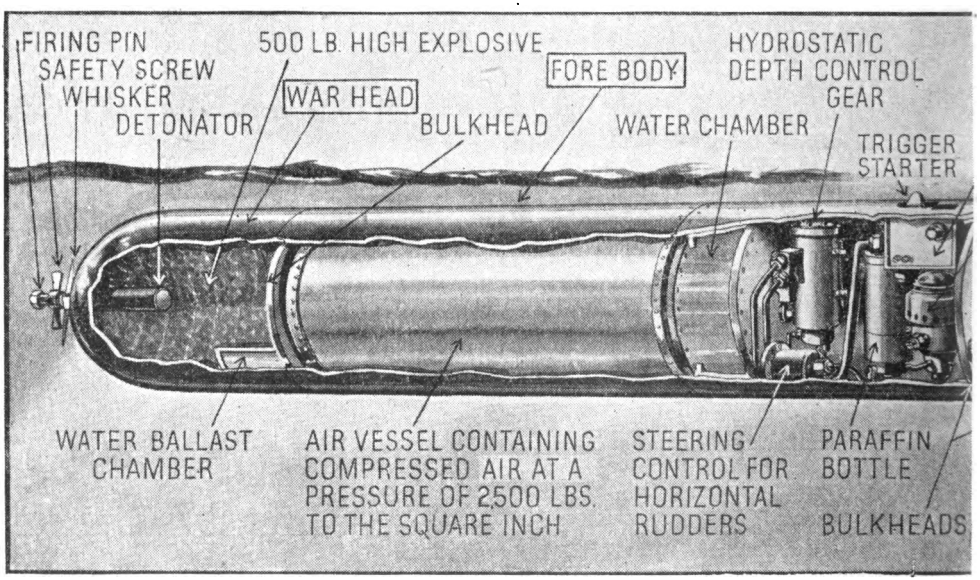
H.M.S. *Truant* left her Scottish port one evening in April, 1940. The weather was calm, and visibility near England good. Weather, in fact, that is excellent for every sort of ship except a submarine, for the calmer the weather the smaller the submarine's chances of remaining in any position for long without being detected.

Near the Norwegian coast, however, H.M.S. *Truant* ran into fog, and it so happened that at that identical moment they became aware of a German convoy on its way up the coast. It is a galling experience to be able to hear your prey and not see to get at it. With modern attack-instruments it is possible to fire blind, and in many instances the gamble is worth it.

The captain of H.M.S. *Truant*, an experienced submarine officer on whose sole judgment the success of the operation depended, however, had some sixth sense which made him exercise patience on a chance of the fog lifting, till lengthening visibility brought the odds somewhat more in his favour.

The risk taken, there came a greater reward than he had dared to hope for. Early the next morning the fog began clearing, and in three hours' time it had all but disappeared. H.M.S. *Truant* went to periscope depth and began her day's watch. It looked like being just another of those monotonous days which dawn with high hope and peter out into gloom. But there was something in the offing. A loud underwater explosion was heard early in the forenoon, and similar though more distant ones throughout the day.

Just before 5.30 in the evening, the curtain rang up. Three torpedo boats were sighted four miles to the north-west. The action hooter sounded and the crew



DIAGRAMMATIC DRAWING OF

A torpedo is the most expensive and deadly of naval projectiles. A 21-in. torpedo costs £2,000 and has some 6,000 separate parts. There is 500 lb. of high explosive forward; the rest of the torpedo is taken up by buoyancy space, and driving and steering mechanism. The buoyancy

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at once sprang to their stations; torpedo tubes were quickly whipped into their action state, and the attack began.

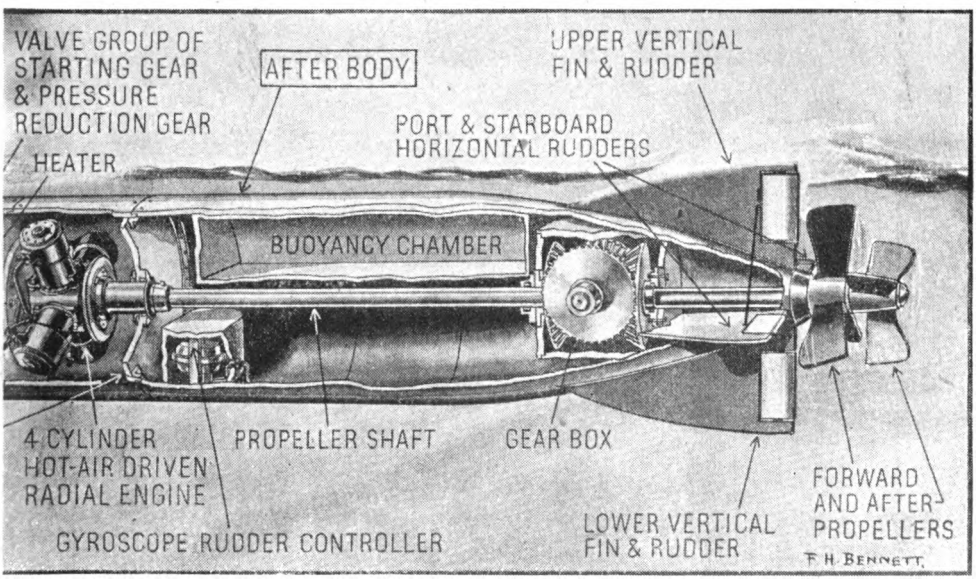
Very few outside the Submarine Service realize how intricate a business is the manœuvring and jockeying for position which must precede any attack. A submarine can only move about a quarter as fast under water as a surface ship, and a mistake in the captain's calculations is in consequence likely to lose him the action.

Then, at 6.30 p.m., the *Karlsruhe* hove into sight. She was hull down, and travelling at some twenty-three knots. H.M.S. *Truant* immediately turned towards the attack. This was the crucial time. The two ships drew steadily nearer, the *Karlsruhe* unaware of the danger in which she stood. The seconds ticked by, whilst the adjusting of instruments went on and the setting of all ten torpedoes of the salvo was finally fixed. Every one in the submarine was keyed up, waiting—waiting. Twenty minutes after the cruiser had been sighted came the order to fire. The climax so eagerly awaited became, in a second, reality.

A few moments later a tremendous explosion took place, followed almost immediately by two more. H.M.S. *Truant's* captain, in his patrol report, described the sounds as of "rending metal." H.M.S. *Truant*, having gone deep, came up to periscope depth to observe the result.

Before this could be done, however, something ominous was seen—a German destroyer approaching at full speed. The submarine crash-dived in record time, and a few seconds later the dreaded depth charge hunt began.

From then on the glamour disappeared, and it became a matter of grim endurance—an endurance of the hardest kind, carried through at the bottom of the sea. The captain of H.M.S. *Truant*, writing in his report, said "The enemy were



THE INTERIOR OF A TORPEDO

compartment prevents it sinking when not being propelled. The hydrostatic valve keeps it at a constant depth, and a gyroscopic rudder controller keeps it on course. The engine is driven by super-heated steam, which, with the products of the combustion of the oil, is fed to the engine

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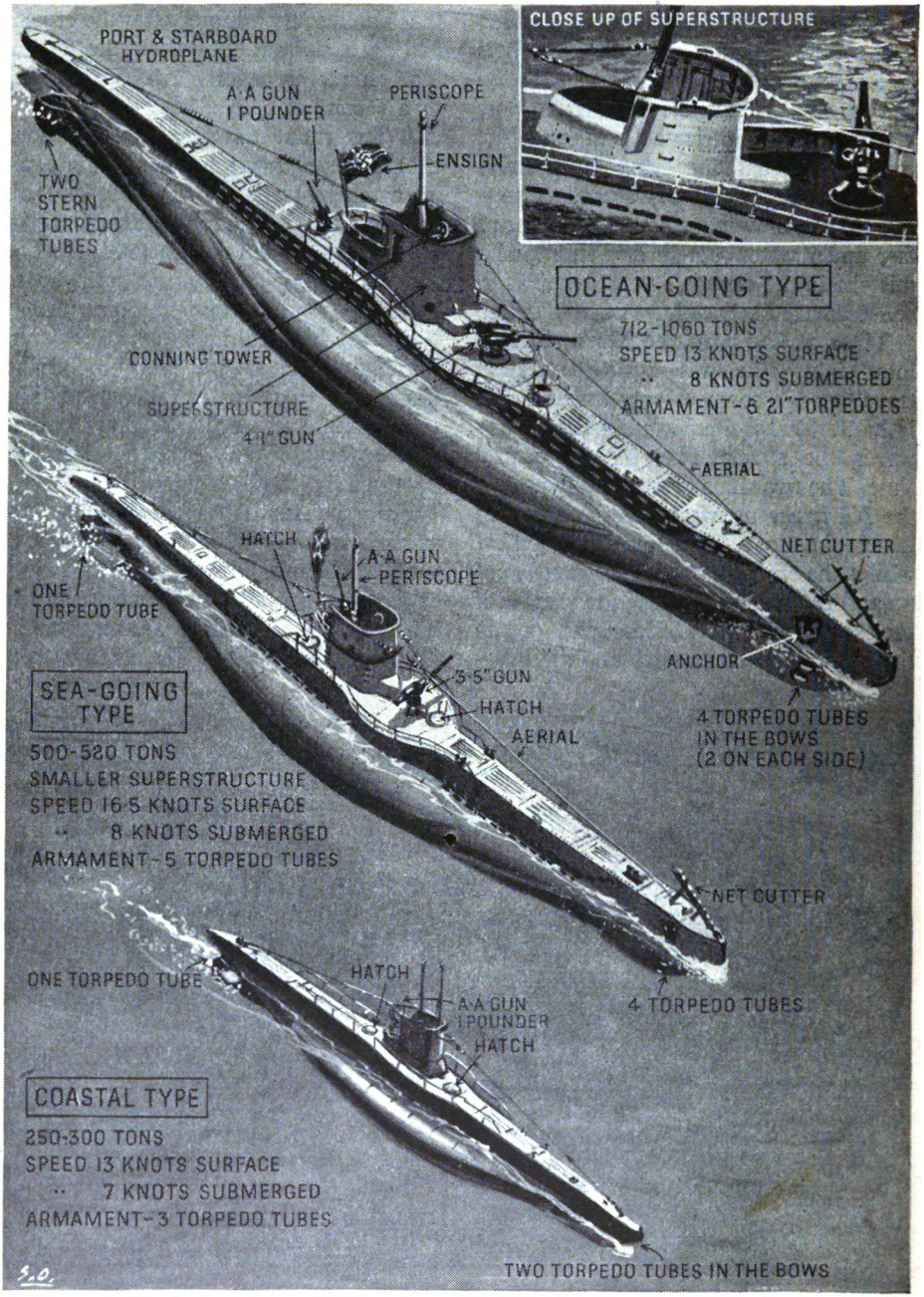

THREE MAIN TYPES OF GERMAN SUBMARINE

The ocean-going type (top) has good speed and a wide cruising range. The sea-going type (centre) has even greater speed but a smaller radius of action. The coastal type (bottom) is smaller still

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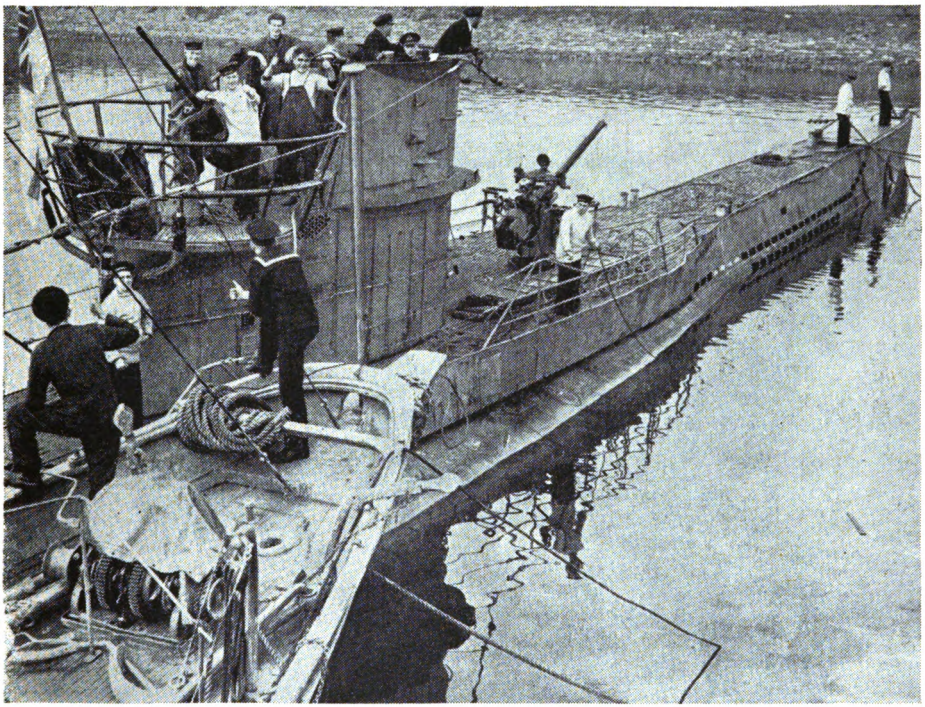
uncomfortably efficient at hunting. I hoped, forlornly, that they would retire after dark on more important business."

The first of the destroyer's depth charges were possibly the most dangerous. They broke several lights and instruments in the submarine and started a number of small leaks. Morale in H.M.S. *Truant*, though, was high. A sweepstake was started on the number of depth charges there would be, and the crew kept up their spirits in the peculiar way that British seamen do in a tight corner.

During the next four hours several hundred depth charges were dropped, but eventually the explosions grew fewer and farther between. At last, after a fairly lengthy and quiet period, H.M.S. *Truant* was brought slowly and silently to the surface of the sea. The enemy had gone.

Thus ended the action in which the *Karlsruhe* was sunk Leaking somewhat, without a compass (the depth charging having seriously affected the magnetism of the boat) and with instruments smashed, H.M.S. *Truant* crept home across the grey North Sea. She was bent and worn —but she had won her laurels and earned a period of rest.

A footnote remains. It is an extract from the commanding officer's report, and it reads: "I was extremely impressed with the steady bearing and efficiency displayed by all officers and ratings during the very trying experience of such determined and persistent depth charging."



A CAPTURED GERMAN SUBMARINE U 570 1941

This U-boat, flying the White Ensign, was captured by a Hudson aircraft in mid-Atlantic. A British crew are seen bringing her into port. It is rare for a submarine to be captured in sea-going condition, and more so for her to surrender, in the first instance, to an aircraft

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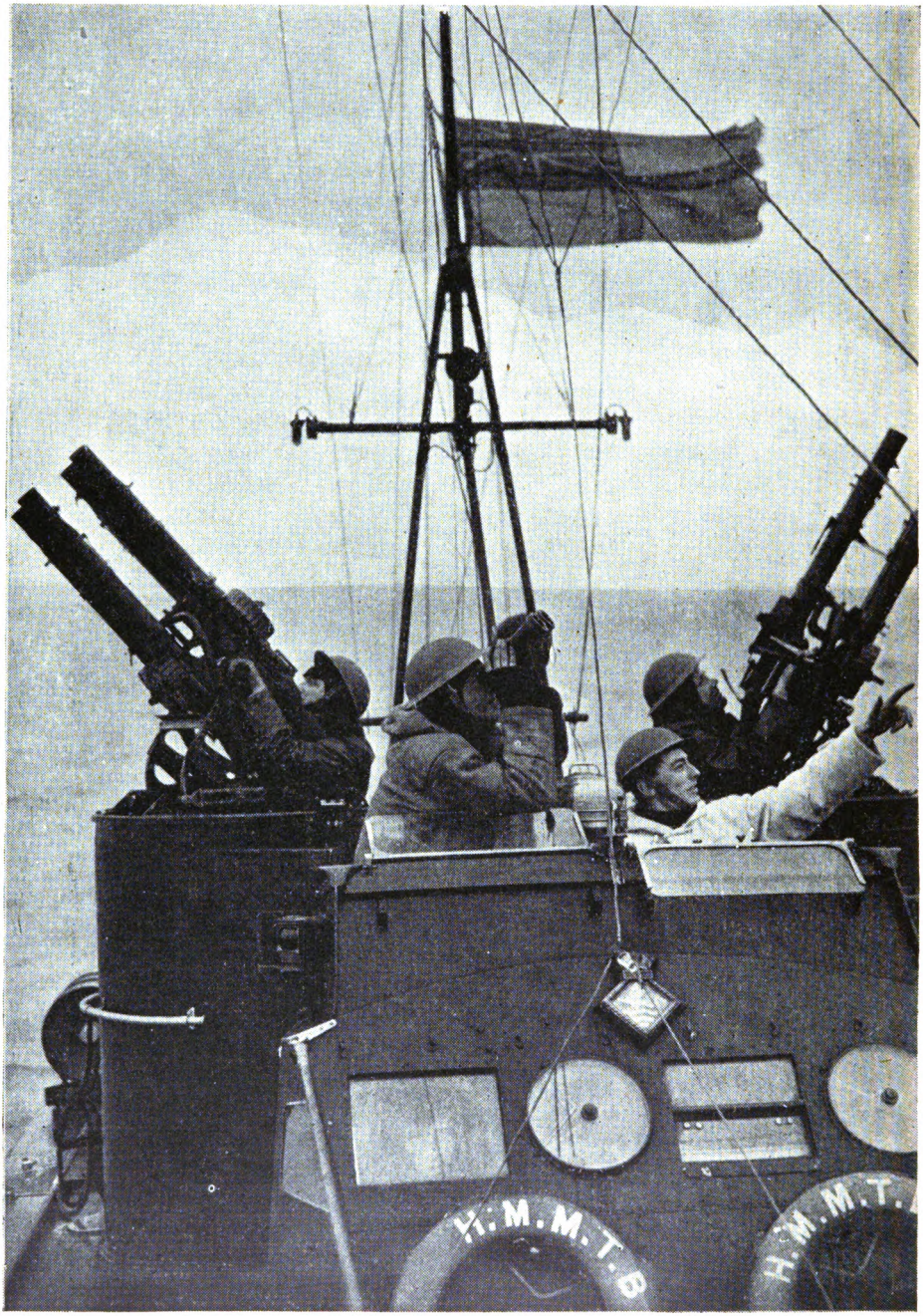

MOTOR TORPEDO BOAT READY FOR ACTION

The continual threat of aerial attack makes it essential that escorting vessels should always be on the alert. The high speed and manœuvrability of these vessels is of great importance

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CHAPTER 10

Small Craft of the Fleet

Sloops or escort vessels. Corvettes or patrol vessels. Trawlers. Drifters. River gunboats. Motor torpedo-boats. Motor gunboats. Armed yachts. Submarine captured by trawler. The Dunkirk rescues. Sludge hopper as emergency transport. Pleasure steamers as auxiliary minesweepers

In the Second World War, to a greater extent than in any previous conflict, the smaller ships have been called upon to do the major portion of the fighting. This is partly to be accounted for by the fact that in heavy ships Germany is so weak as to be unable to risk them in a fleet action with any chance of success.

She has therefore been obliged to fall back upon submarines, used ruthlessly against commerce in violation of all undertakings, and on other craft of the kind usually classed as "minor war vessels" to operate against us at sea. To counter this policy, small ships of the Royal Navy have been used to defeat enemy attacks.

CONTRIBUTION TO VICTORY

In view of the extent and importance of their work, separate chapters of this book are devoted to cruisers and destroyers, submarines and minesweepers. But this leaves other categories whose contribution to the ultimate victory needs to be chronicled in the present chapter.

In a message to the Mediterranean Fleet, Admiral Sir Andrew Cunningham, the Commander-in-Chief, referred to the eight months of siege sustained by Tobruk, during which time the task of maintaining the garrison's bodily needs and war supplies had fallen on the Royal Navy and units of the Merchant Navy. Most of the work, he emphasized, had fallen on destroyers and the small ships.

In conclusion he added: "I have watched with admiration the work of the little ships. They have borne the burden of the day, but neither fatigue nor assaults of the enemy have deterred them. Their achievement is one of which all may well be proud."

Largest of these "little ships" are the sloops, of which, when war began, there were thirty-one belonging to the Royal Navy, with four more building; two in the Royal Australian Navy, with a couple more building; and five in the Royal Indian Navy, four others to be built as rapidly as possible.

In displacement these sloops range from about 900 to close upon 2,000 tons, and, in date of launch, from 1915 to 1941. Armament varies somewhat, but is invariably composed of either 4-in. or 4·7-in. guns. Speeds are from 14·5 to a trifle over 19 knots. Thus it will be seen that, though in displacement sloops are not a great deal smaller than destroyers, they are decidedly slower. At one time they were known as "escort vessels," a function for which they are well designed; war pressure has compelled the construction of a smaller, quickly-built type, the corvette.

Corvettes were originally known as patrol vessels, and were so rated during the war of 1914-18. In September, 1939, there were ten in the Royal Navy and an eleventh in the Royal Indian Navy. There were under construction fifty-six more of

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an improved design, based upon the whale catchers built for the Antarctic whaling fleets. All the fifty-six first built, with a great many more that have since been constructed for the Royal Navy, Royal Canadian Navy and Royal Indian Navy, have done excellent service in escorting convoys across the Atlantic.

Pre-war corvettes were of from 510 to 610 tons in displacement, had a speed of twenty knots, and mounted a 4-in. gun as the main armament. Depth charges for anti-submarine attack were an outstanding feature. Though official particulars of the war-built corvettes are scanty, American authorities describe them as of 725 tons, seventeen knots speed and with an armament similar to their predecessors, though with an enhanced number of small anti-aircraft weapons. The type has performed invaluable work in the Battle of the Atlantic.

Next in order of importance come the trawlers. There were about eighty in the Royal Navy and the various Dominion Navies when war began, while sixty-seven more had been purchased under the 1939 Supplementary Estimates and were in process of being equipped. A great many more were immediately acquired and have proved their value in many different ways.

THE TYPICAL TRAWLER

A considerable proportion are engaged in mine sweeping, but coastal convoys and patrol duties have absorbed a large number. Casualties have been severe, numbering 128 up to the date of writing. Many more have been built since the Second World War began. Though they vary in displacement from 134 to 641 tons, the typical trawler of the Admiralty *Tree* class is of 600 tons, with a speed of twelve knots and an armament of one 4-in. and sundry smaller anti-aircraft guns, besides depth charges.

Another small warship that in peace time would be regarded as a fishing vessel is the drifter. There were twenty-five in the Royal Navy before the war, their services being chiefly employed as tenders to capital ships, from which they were manned. With war, however, there came a great increase in their numbers.

RIVER GUNBOATS

Though their shallow draught precludes their employment in other than coastal operations, the twenty-two river gunboats with which we entered the war, designed for service on the Yangtze and other Chinese waterways, have proved their usefulness in various directions, notably in the Libyan campaign. In displacement these little vessels range from 185 to 700 tons, and in speed from eleven to seventeen knots. Some of the older ones mount 6-in. guns, but the latest are armed with 4-in., and some have a 3·7-in. howitzer as their principal piece.

Motor torpedo-boats originated in the war of 1914-18, when they were officially known as "coastal motor boats." In September, 1939, there were twenty-four in service ranging from eighteen to thirty-two tons, but this figure has since been multiplied. The Dominion Navies, which possessed none in 1939, have lately acquired a number. Speed is the chief asset of the motor torpedo-boat. Ability to creep up at night under auxiliary power, which enables them to move semi-silently, is also an important factor. Once within torpedo range, retreat at forty-five knots or more is relied on to avoid destruction after their torpedoes have been discharged. In the later types two 21-in. torpedo tubes constitute the main armament; 20-mm. guns are also included.

Since the outbreak of hostilities, motor gunboats have also been put into service. These are enlarged and improved editions of the motor launches of which so many were built in the war of 1914-18. In unofficial accounts of these vessels' activities in the Channel and North Sea, they are

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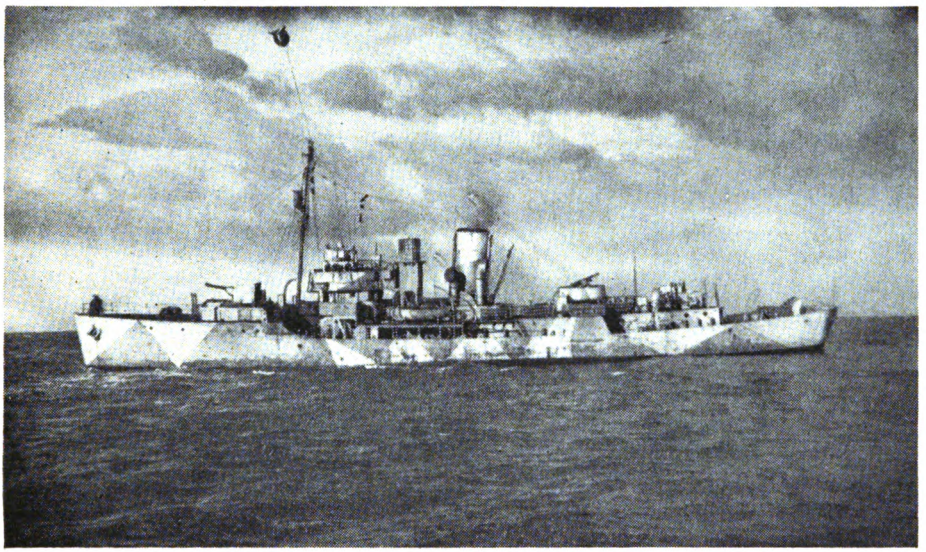
described as being armed with pom-poms and heavy machine guns and as having speeds in excess of forty knots. From official photographs they appear to be modified versions of the motor torpedo-boats already described, though a trifle bigger and more heavily built.

Armed yachts are another type of small craft which will be found in the war casualty lists. How many were taken up for patrol service by the Admiralty at the start of the war is not known. In the withdrawal under fire of British and French troops from Dunkirk in May and June, 1940, hundreds of small craft of every imaginable kind were employed. In fact, the total, including naval units, amounted to 887, though this is believed to omit a number of small boats not reported officially. That such an immense number of vessels could have been assembled and brought to the spot where their services were so urgently needed in time to evacuate over 335,000 officers and men may well seem miraculous. It certainly reflects immense credit on the Admiralty, who some time beforehand arranged for all privately owned motor craft of from thirty to one hundred feet in length to be registered and held at their disposal in case of need. When that need arose, it was merely necessary to issue orders by telegraph and telephone for the vessels to be handed over by their owners. In addition, the Ministry of Shipping by means of its licensing system was able to lay hands at short notice on a number of coasting vessels which also played their part in the evacuation.



TYPICAL BRITISH CORVETTE ON PATROL

Corvettes are quickly-built patrol vessels of between 500 and 700 tons. They carry powerful depth charges and a 4-in. gun. Their principal use is in escorting convoys of merchant ships

Embarkation began on May 27, 1940, and was continued without cessation until the night of June 3 and 4, when the last troops left; the enemy occupied Dunkirk in the course of the following day. For the whole of the period, the ships and personnel engaged in transporting the troops were subjected not only to enemy gunfire while near the Belgian and French coasts, but were incessantly bombed from the air and occasionally attacked by

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German motor torpedo-boats. Though losses were heavy, the progress of the work was never interrupted, and naval aircraft and R.A.F. planes were constantly engaged in counter attacks on the enemy air squadrons, which materially aided the work of embarkation.

In addition to the various types of minor war vessels mentioned, the craft employed in the Dunkirk operation included Thames barges, lifeboats, pleasure steamers, outboard motor boats, and every kind of fishing boat. In the official list of losses there figured not only destroyers, but minesweepers, a river gunboat, trawlers, drifters, armed boarding steamers and a buoy-laying vessel.

In the withdrawal of troops from Greece (and later from Crete) many small craft figured, though few particulars of their activities have been published. Some soldiers even saved themselves on rafts, which drifted across to the African coast. To give a complete account of all the actions in which small craft have distinguished themselves would absorb far too much space, but a few instances may be recorded as typical of the whole.

A BRITISH ARMED TRAWLER AT SEA

These trawlers, the fishing vessels of peace time, are mostly used as minesweepers. They go out in all weathers and keep the sea lanes clear of mines laid by enemy submarines and aircraft

In the operations on the coast of Norway in April and May, 1940, excellent service was performed by armed trawlers. At Namsos, H.M.T. *Arab* particularly distinguished herself. Incendiary bombs set fire to the wharf on to which a large quantity of hand-grenades had been discharged. Lieutenant Stannard, R.N.R., commanding H.M.T. *Arab*, ran alongside the wharf and after two hours' work

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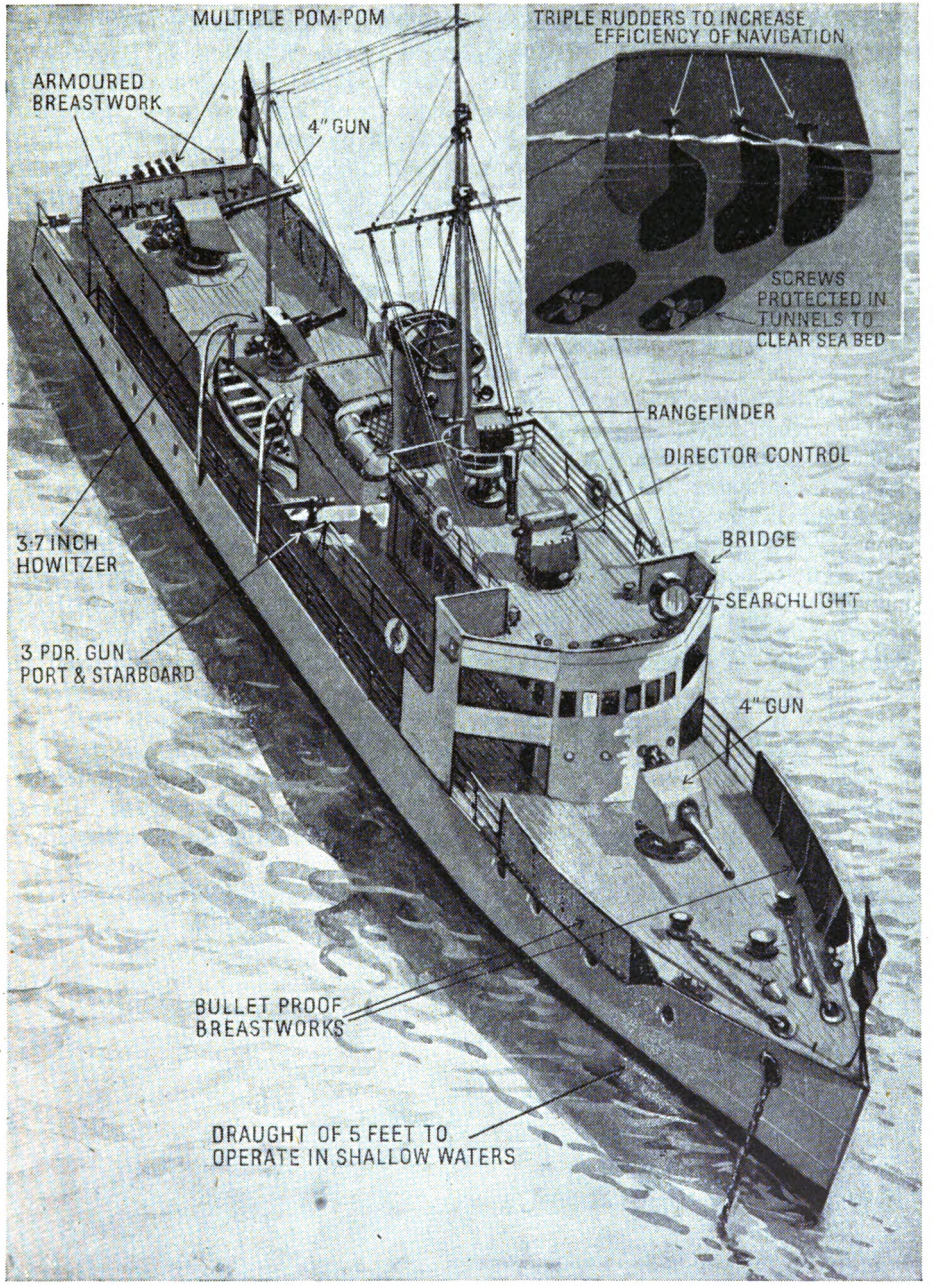

DIAGRAMMATIC DRAWING OF A RIVER GUNBOAT

Gunboats are still much used in rivers. They can operate in shallow waters, their engine screws being protected in tunnels. Triple rudders make them easier to navigate in currents. They are lightly armoured and carry two 4-in. guns, a 3.7-in. howitzer and two 3-pounder guns

B.G.N.—G

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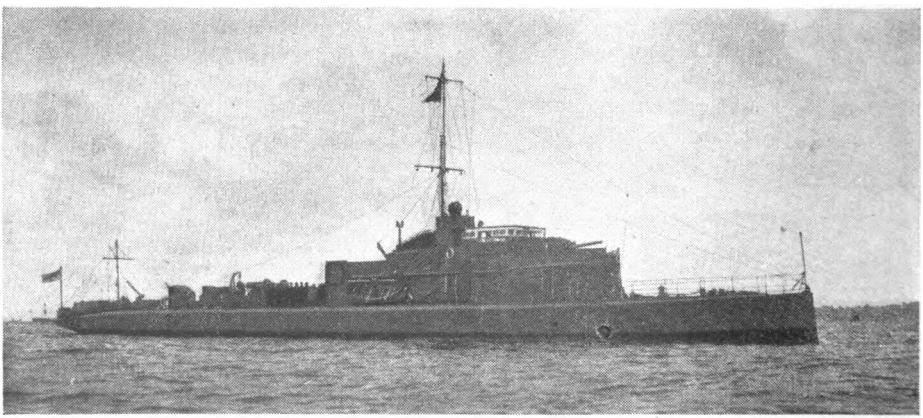
overcame the danger. Later he fought with other trawlers against persistent attacks by aircraft, ultimately running his ship under an overhanging cliff which afforded some protection against bombs. He then established a camp ashore with the crews of two other trawlers, enabling the men to obtain some sorely needed rest from the incessant bombing.

One of the trawlers was set on fire, and the trawler *Arab* had to be shifted away from the blazing ship, which soon afterwards blew up. Finally the *Arab* was obliged to leave the fjord in which she had been lying, and was attacked by a German bomber as she emerged. Waiting until the aircraft was quite close, Lieutenant Stannard opened fire and brought it down. For his gallant conduct through this series of operations, Lieutenant Stannard was awarded the V.C. It is interesting to note that he had taken the trouble to obtain a record of the past services of H.M. ships named *Arab*, and displayed it in a prominent position on board his trawler for the inspiration of the ship's company.

To a trawler belongs the distinction of having out-fought an enemy submarine, forcing it to surrender and to be brought in as a prize. This was the Italian submarine *Galileo Galilei*, a vessel of 880 tons, armed with two 3.9-in. guns and manned by over fifty officers and men. She had been operating in the Red Sea from the Italian base at Massawa when sighted by the trawler *Moonstone*.

It appears that the *Galileo Galilei* left Massawa with the object of attacking British supply ships passing through the Strait of Bab-el-Mandeb. She actually fired a torpedo at a small tanker entering the Red Sea on June 16, but was immediately spotted by a destroyer and was obliged to crash-dive. She was depth charged, several plates being started and the air-conditioning apparatus damaged. By the time it was safe to return to the surface the atmosphere inside the submarine was foul. In less than an hour, smoke on the horizon compelled the *Galileo Galilei* again to seek refuge on the sea bottom. This process of submerging hurriedly was repeated with such frequency during the ensuing two days that by June 19 the crew were in bad condition.

She was still on the surface at daybreak on June 19, when an aircraft spotted her.



BRITISH SHALLOW-DRAUGHT GUNBOAT

The characteristic lines of a river gunboat are clearly shown here. Such ships draw very little water and their light armament is often of great use in river fighting or coastal patrolling. Their speed is about fifteen knots and their draught only five feet. (*For armament—see page 193*)

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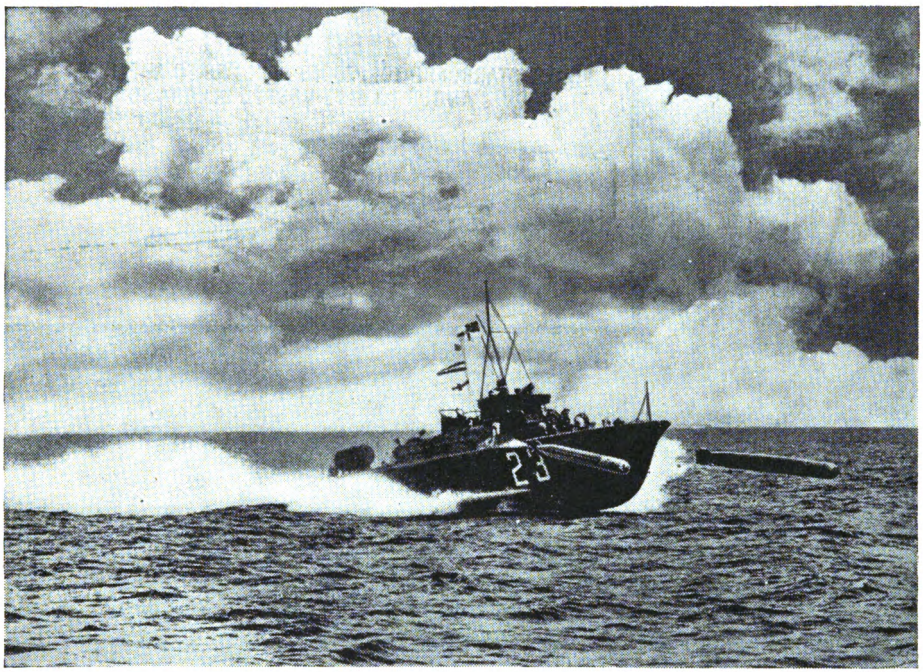

A BRITISH MOTOR TORPEDO-BOAT FIRING TORPEDOES

These torpedo-boats are fast and powerful. They carry torpedoes, depth charges and a light A.A. armament. Two torpedoes are shown being fired from the deck tubes on each side of the ship

Though the captain of the submarine submerged in the hope that she had not been observed, she was undeceived some time later when the explosion of depth charges around her indicated that pursuers were again on her trail. Unable to stand submersion any longer, the submarine broke surface at 12.30 p.m. to find the *Moonstone* ready for her. The trawler had made contact with the *Galileo Galilei* an hour before by means of her Asdic detector apparatus, and had been dropping depth charges systematically in order to force the enemy craft to rise to the surface.

When sighted the submarine was dead astern of the *Moonstone*, about a mile away, and heading in the opposite direction. Turning in chase, the *Moonstone* opened fire with her single 4-in. gun, the second round from which hit the submarine's conning tower and burst inside, killing the commanding officer. Though the enemy returned the fire from their two 3.9-in. weapons, their aim was not effective. Approaching to within half a mile, the trawler's Lewis guns opened up a heavy fire which drove the Italians from their guns. At the same time spare members of the *Moonstone's* crew formed a sniping party with rifles, which kept up a slow and deliberately-aimed fire.

Hit a second time on the conning tower by a 4-in. shell, the submarine stopped, and, to quote from the official report of the boatswain, W. J. H. Moorman, R.N., in command of the *Moonstone*, "The crew rushed on deck, and hauled down their colours, while those who had any clothing of a white nature waved it frantically. This was accepted as a token of surrender." For this fine service Moorman

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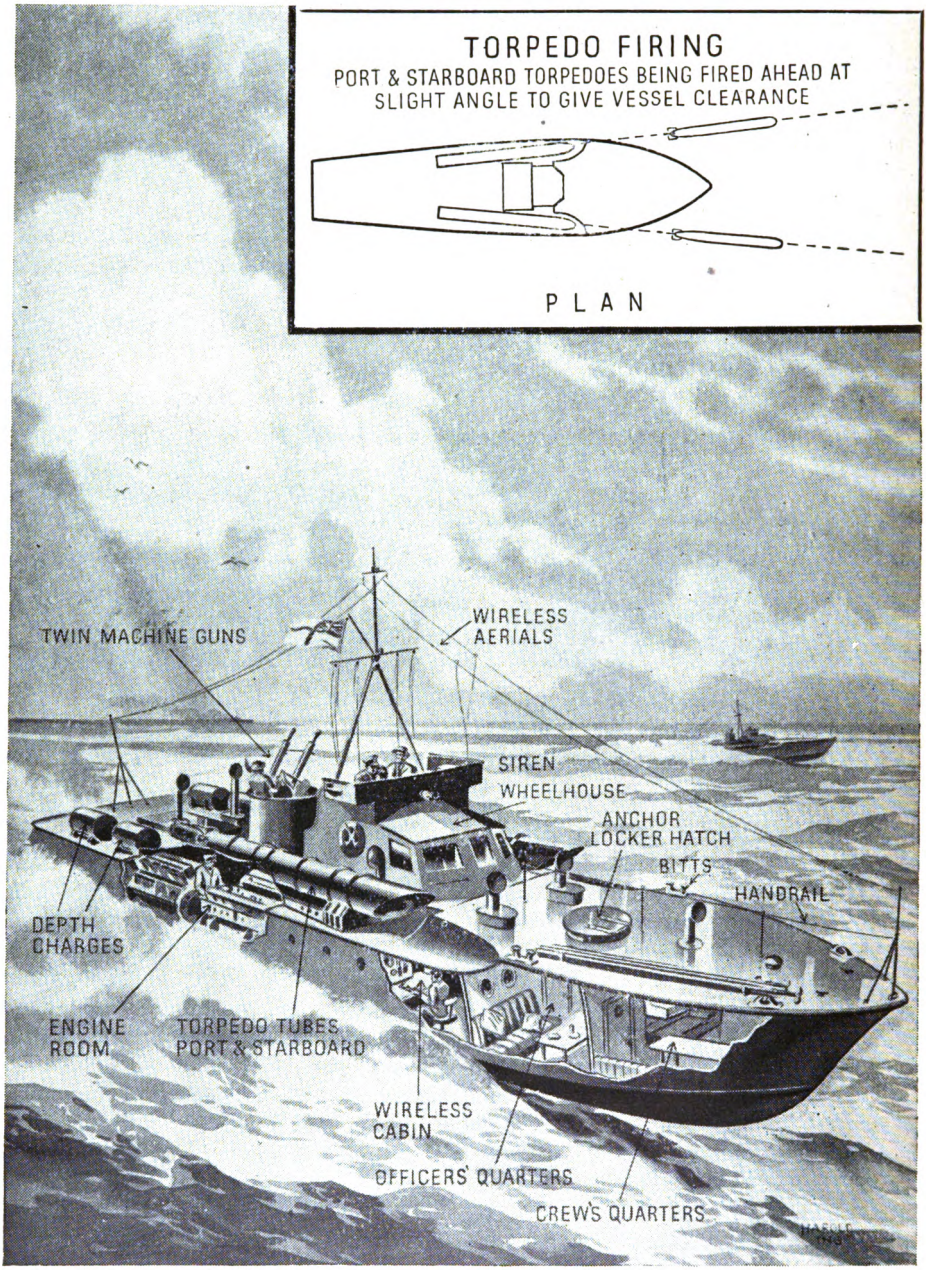

DIAGRAMMATIC DRAWING OF A MOTOR TORPEDO-BOAT

These torpedo-boats have a displacement of about thirty tons and a speed of well over forty knots. They carry two 21-in. torpedo tubes. They have an auxiliary engine fitted for silent approach, which automatically turns over to the main engine when the speed exceeds nine knots

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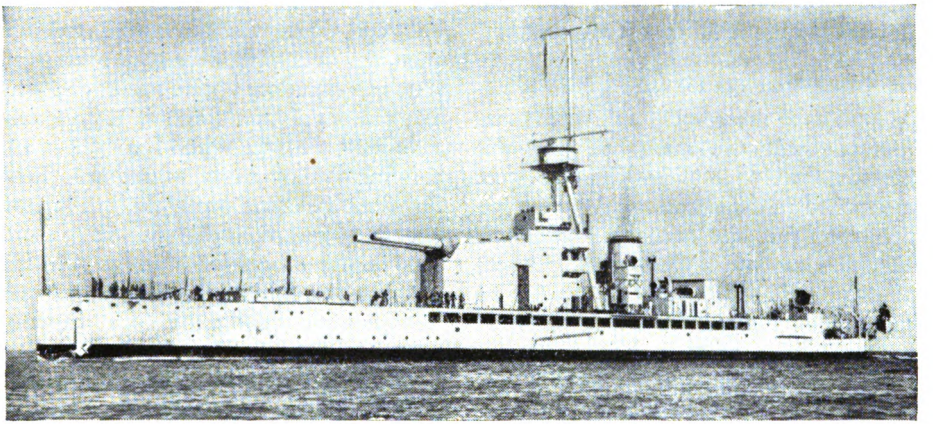
was awarded the Distinguished Service Cross and selected to undergo the courses for promotion to lieutenant.

Another instance of an enemy submarine being forced to surrender to a trawler occurred in October, 1941. The trawler was the *Lady Shirley*, Lieutenant-Commander A. H. Callaway, R.A.N.V.R. While on patrol she sighted a large German submarine which had been forced to the surface by means of depth charges. As in the case of the *Galileo Galilei*, the enemy was at once engaged by the trawler with her 4-in. gun and machine guns. Though the crew of the submarine tried to man their gun, the machine-gun fire drove them from it, whereupon they manned their own machine guns, mounted in the conning tower. Fire from these killed the *Lady Shirley's* gunlayer, but his place at the 4-in. gun was at once taken by Sub-Lieutenant F. E. French, R.N.R., who kept the gun in action and scored several hits on the U-boat.

Meanwhile Seaman Windsor and Seaman Halcrow, who were manning the *Lady Shirley's* machine guns, kept up a continuous fire, although both had been wounded. After receiving several hits from 4-in. shells the Germans held their hands above their heads and shouted out to indicate they were surrendering. The *Lady Shirley* then ceased fire, and the submarine sank. Altogether forty-four survivors of the U-boat were picked up, quite outnumbering the trawler's complement, which was thirty. They were landed at Gibraltar as prisoners.

In this case, as in the preceding one, the enemy vessel was larger and better equipped than the one which overcame her. Moreover, it is to be presumed that the enemy submarine crews were composed of regular naval personnel, whereas H.M. trawlers are manned by members of the Royal Naval Patrol Service, who had entered the Service for the duration of hostilities only.



H.M.S. EREBUS, A BRITISH MONITOR

After a period as a training ship, H.M.S. Erebus is again commissioned for duty. Her displacement is 7,200 tons and her complement is 315. The gun house and barbettes are strongly armoured. Though 400 feet long and with a beam of 88 feet, her mean draught is only 11 feet

In the early part of the war, when experience of enemy methods of air attack was slight, a good many trawlers fell victims to German bombers. In one case where two bombs fell so close to the trawler as to cause a serious leak, the ship was saved by the devotion to duty of the engine-room staff. The commanding

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officer, a skipper, R.N.R., reported in the following terms on their grand conduct:

"Clouds of steam were coming from the engine-room, which was in darkness. I called on the first engine-man, A. R. Isbister, and found him stripped and covered in black grease as he struggled with the machinery, assisted by the second engine-man, W. H. Osborn. They were getting the utmost out of the pump and plugging up holes with timber. I asked the first engine-man if he thought he could get a turn out of the engines, and he replied cheerfully: 'I think I'll have her going O.K. in a few minutes.'"

MENTIONED IN DISPATCHES

Thanks to the bravery and determination of these two men, the ship was brought safely into port. Both were mentioned in dispatches.

During the first advance into Libya, H.M.S. *Ladybird*, a China river gunboat of 625 tons, did invaluable service in support of the Army, shelling enemy batteries and assisting in the reduction of fortified positions. Her captain, Commander J. F. Blackburn, R.N., a former chief officer of the training ship H.M.S. *Arethusa*, was awarded the D.S.O. for this service. Later he was given a bar to the D.S.O., after his ship had been sunk at Tobruk in an action of which details are given in his own words:—

"Chief Petty Officer Thornton-Allen was in charge of the 20-mm. Breda gun when a combined high level and dive bombing attack was made on H.M.S. *Ladybird* in Tobruk Harbour. She was hit by two big bombs from a high level, and she settled down by the stern at once. Two fierce oil fuel fires were started, dangerously close to the ship's magazines. Thornton-Allen was wounded and blown from his gun by the blast from the bomb explosion; but he at once got back to his gun, got it into action, and had the satisfaction of shooting down one of the German dive bombers—a large number of which were now attacking the ship.

"As a matter of fact, all my guns, with the exception of the after pom-pom, which was 'knocked for six' by the first bomb, remained in action in the midst of a veritable hail of bombs, and it is entirely due to the magnificent work of the guns' crews that we drove off their dive bombers without getting another direct hit. I regret to report that the machine gun manned by the captain jammed after firing one round, and he was left to defend the happy home with a rifle.

"Petty Officer Booker, an old *Arethusa* man, was in charge of the after pom-pom. The rest of his crew were killed, and why he was not I don't know, but fortune favours the brave. When I got down aft, I found Booker badly wounded in both arms and bleeding profusely, but he had shown no regard for his own safety, and was taking charge of a party rescuing wounded men from the fire, into which they had slid along the deck, slippery with oil fuel."

Fortunately the water was shallow, and H.M.S. *Ladybird* grounded on the bed of the harbour with her deck partly awash. Her guns continued to operate against the enemy in subsequent attacks.

FIRST SLOOP SUNK

H.M.S. *Bittern* was the first sloop to be sunk by air attack. This was during the Norwegian operations of April, 1940. She was repeatedly attacked while lying in a fjord, and after prolonged fighting, in which one aircraft was brought down in flames and others damaged, was set on fire. Efforts to overcome the fire proved unsuccessful, and she had to be abandoned and sunk by our own forces to avoid becoming a danger to navigation.

Though there have been several encounters in the Channel and North Sea between our motor torpedo-boats and those of the enemy (which for no

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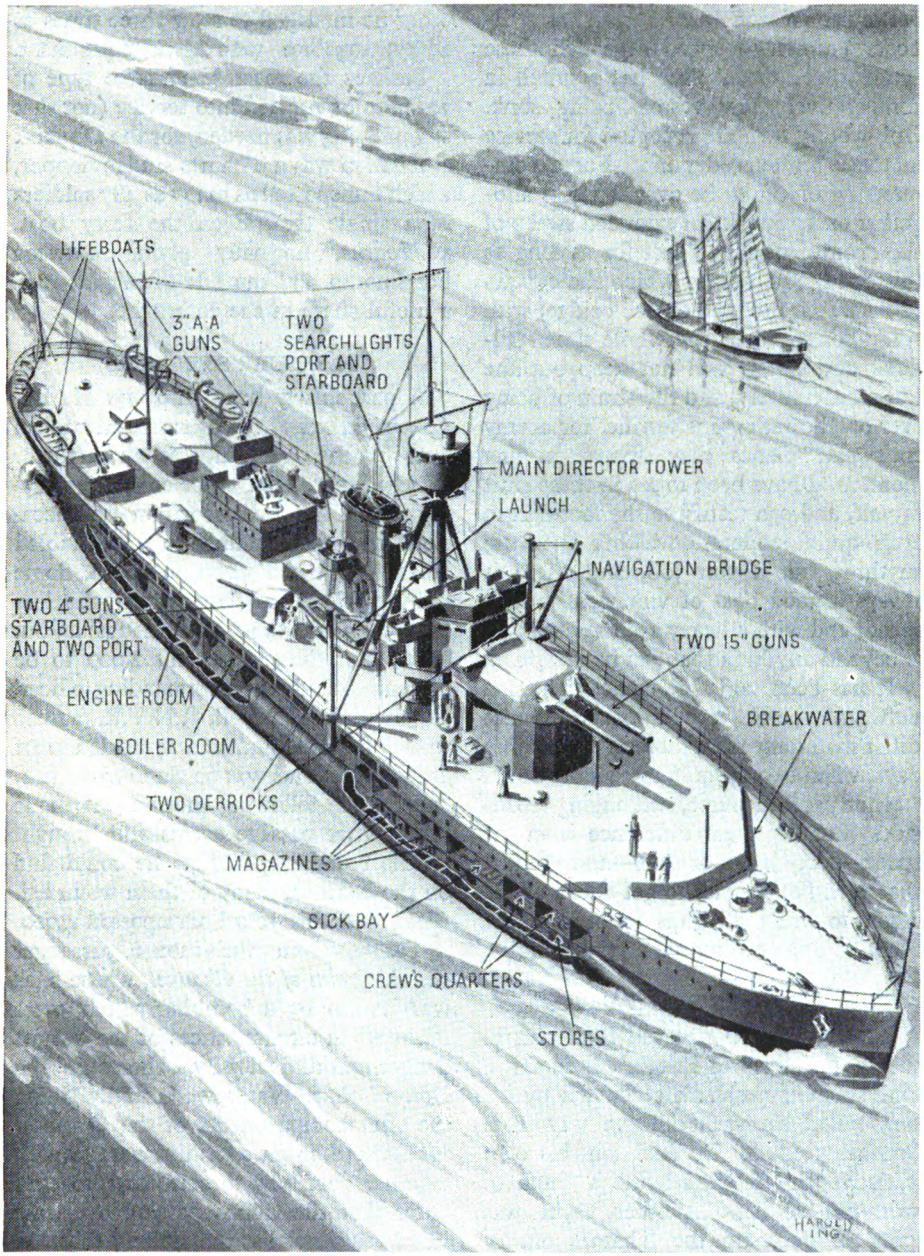

DIAGRAMMATIC DRAWING OF A MONITOR

Although not strictly speaking small craft, these ships are used for shallow water operations and, though slow, are powerfully armed and have a draught of less than twelve feet. They carry two 15-in. and many smaller guns. The 15-in. guns are high-angle and have a range up to 40,000 yards. Such ships have bulges fitted with about fifty water-tight compartments

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particular reason are known as "E-boats") the high speed at which these actions have taken place has resulted in comparatively few vessels being sunk. Only young men are accepted for service in these high-speed craft. For a commanding officer to be over thirty is altogether exceptional. An extended sweep of the enemy coast may last for as long as thirteen hours, during which the captain of a M.T.B. must be on the bridge, with spray coming over the whole time. Oilskins and hoods will not keep out the water indefinitely, and the strain of being ever on the *qui vive* is terrific, for enemy craft and planes may appear at any moment. I have been to sea in these craft myself, and can testify to the fact that in even quite moderate weather they are anything but a soft job, and there is always a good deal of vibration at high speed; and with a heavy sea the bumping is beyond anything that can be imagined.

It has been said that tactics in action between motor torpedo-boats do not differ materially from those of sailing ship days, when two fleets in line ahead would steer on parallel course, exchanging broadsides. But the great difference is in the speed—forty knots or over—and the fact that each flotilla tries to get ahead of the other, to bring all guns to bear in the event of one turning off at right angles.

TROOP-CARRYING YACHTS

Yachts, too, have played their part in the stirring story of Britain's little ships. One amateur yachtsman, assisted by his son, sailed his yacht all the way from Southampton to Dunkirk on his own initiative and fetched home a batch of worn-out soldiers. Another yacht was lying in dock up the Thames out of commission, but was taken down river and across the Channel in record time. When asked how many troops she could carry, her owner took a risk and said "Fifty at a pinch." Yet somehow or other he managed to stow three times as many, together with their equipment.

Perhaps the most remarkable type of vessel to be pressed into service (not that any pressing was needed) for the Dunkirk evacuation was a Thames sludge hopper, which transported as many as 487 soldiers in a single trip. Even the ferry boat, *Fishbourne*, normally plying between Portsmouth and the Isle of Wight, took a useful share in the enterprise.

PLEASURE STEAMERS

A particularly busy ship was H.M.S. *Queen of Thanet*, a pleasure steamer taken over by the Admiralty as an auxiliary minesweeper. After twice crossing, carrying several hundred troops on each occasion, she was called upon to aid a disabled vessel which had 3,000 on board. Some had been taken into destroyers by the time the *Queen of Thanet* came alongside, but on finding there were still 2,000 to be accommodated, the commanding officer, Commander Halliwell, R.N.V.R., agreed to take them all, and he duly landed them at Margate. This was on Sunday, June 2, and on the following morning he made yet another passage across and brought all the remaining soldiers he could find on the beaches, many of them wounded. Altogether this vessel transported 4,000.

Troops from the motor passenger vessel, *Queen of the Channel*, whose back was broken by a bombing attack, were taken off in circumstances of the utmost danger and difficulty by a shoreship, the *Dorrien Rose*. Water was rapidly filling the after compartments of the *Queen of the Channel*, so the two ships were secured together port bow to starboard bow, in order that the troops passing over one side should not list the sinking ship. As they passed on board the *Dorrien Rose*, they were ordered over to the farther rail, and the transfer of 920 men was thus completed safely. All this was done in the small hours, fine weather aiding the

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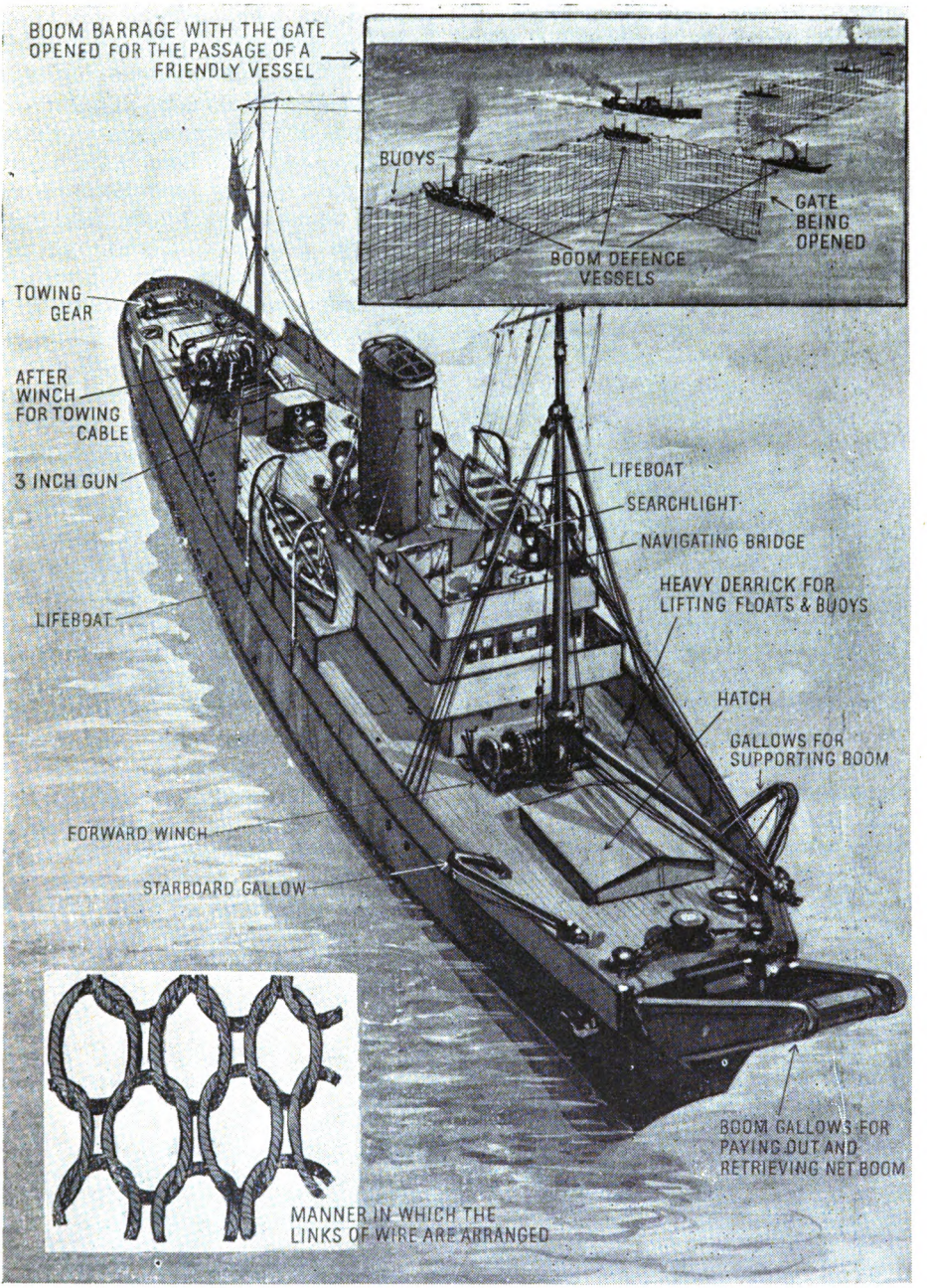

DIAGRAMMATIC DRAWING OF A BOOM-DEFENCE SHIP

Nets of strong steel wire, woven as in the inset, are still used as anti-submarine defences of vital ports. These nets are attached to boom-defence ships, which have special gear as shown above. Their usual displacement is between 300 and 500 tons and they have one 3-in. A.A. gun

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process. At one stage German aircraft again attempted to interfere, but were driven off by fire from the *Dorrien Rose's* machine guns.

A typical narrative is that of Captain Buxton, master of the General Steam Navigation Company's *Bullfinch*:—

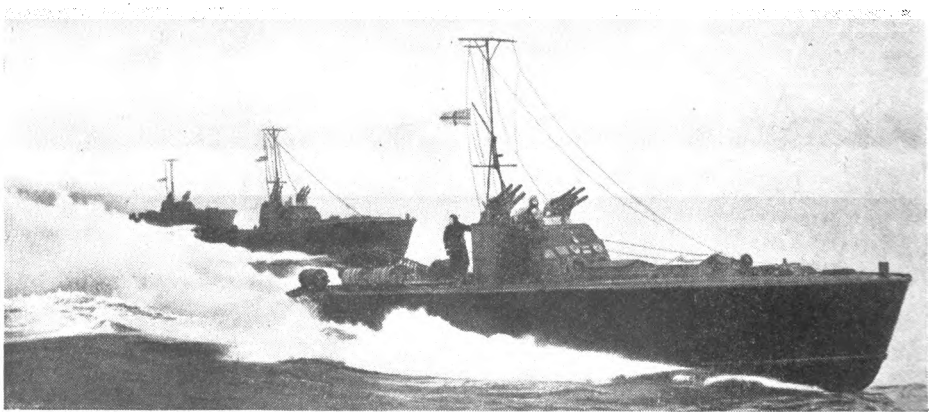
"At 10.20 p.m. on May 28, 1940, whilst at anchor in the Downs, the *Bullfinch* received orders to sail at once for La Panne beach. The ship arrived there about 4.50 a.m. on May 29. The beach was crowded with troops, but there were only a few boats bringing off small numbers. The master received orders to beach the *Bullfinch*, and accordingly let go the kedge anchor and headed slowly for the beach. The vessel grounded about 5.45 a.m., but owing to the kedge anchor not holding, her stern swung and the ship was aground fore and aft with the beach.

"After the first boatload came aboard, one of the soldiers swam ashore with a line. Two 5-in. ropes were then run ashore and hauled boats off and back to the beach. When the tide receded the troops waded off and embarked up the ship's ladders. Embarkation proceeded until there were about 1,500 on board, during which time the ballast tanks were pumped out. The ladders were then pulled up, as the ship could take no more.

"The troops had two Bren guns with them, which were mounted on either side of the boat deck. The troops also manned the ship's Lewis gun. Bomb attacks were taking place all day, and after a very anxious time the vessel floated and proceeded at 6.15 p.m. German aircraft attacked the ship repeatedly. When passing Dunkirk several bombs dropped close to the vessel's stern, the concussion from which put the steering gear out of action. Engines were stopped whilst repairs were effected, and the ship then proceeded.

"Three dive bombers then attacked the *Bullfinch* from aft. One of the Bren gunners, Sergeant Cook, shot one down into the sea. Shortly afterwards three others attacked from forward, and the sergeant again shot one down. Further attacks were made at frequent intervals until a formation of Spitfires drove off the enemy. On arrival in the Downs the *Bullfinch* received orders to proceed to Ramsgate Harbour, where the troops were promptly disembarked.

"It was afterwards discovered that the concussion from the exploding bombs had put both compasses out. The ship



BRITISH SUBMARINE CHASERS ON PATROL

These small power boats are armed with two light multiple A.A. guns and have depth charges on board. Their smallness and speed make them a difficult target for destroyers or aircraft

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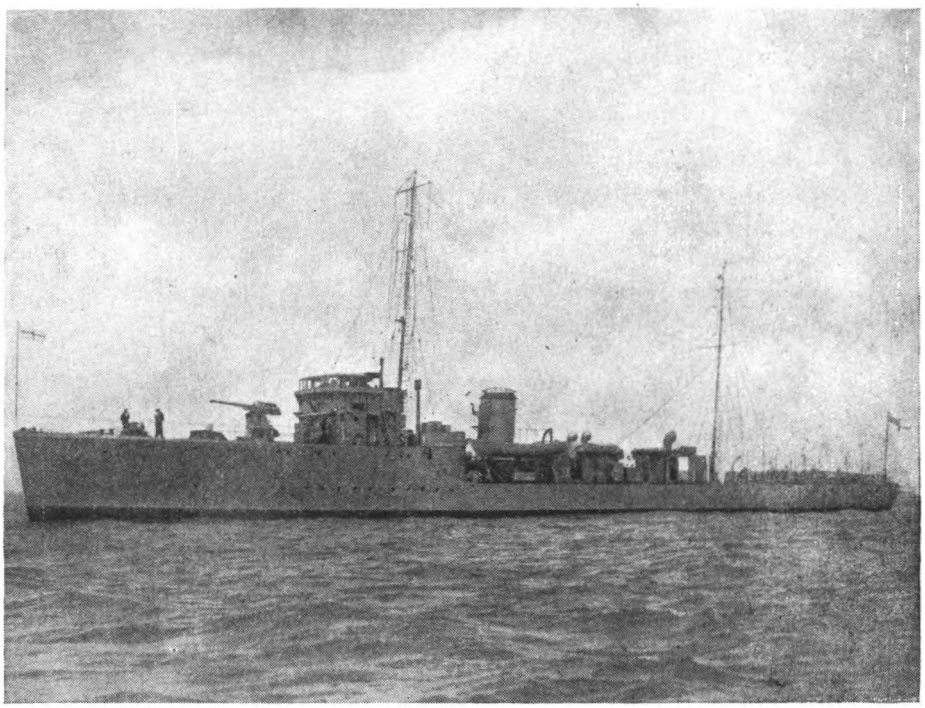

A BRITISH ESCORT VESSEL

Modern conditions of sea convoy make a big call upon the lighter ships of the Royal Navy. These lightly armoured escort ships, together with corvettes, greatly assist the destroyers

was on one occasion attacked by machine gun fire, but only one soldier was wounded. The master of the *Bullfinch* cannot speak too highly of the Bren gunner, who held his fire until the planes were close, and thus saved the ship."

Another yacht deserves to be mentioned, H.M.S. *Campeador V*, a little steam vessel of 213 tons Thames measurement, built at Dartmouth in 1938, and owned by Mr. V. W. McAndrew. She was commissioned for patrol service by Commander C. H. Davey, R.N., Master of the Dartmoor Foxhounds, and the three sub-lieutenants R.N.V.R. appointed to her were Mr. McAndrew, the owner, Mr. C. E. Turner, a dock superintendent, and a retired Surgeon Rear-Admiral, J. R. Muir. The youngest of these men was fifty-eight and the oldest sixty-seven.

The *Campeador V* soon acquired a high reputation for remaining on her station and refusing to return to port to remedy defects if these could possibly be dealt with at sea. She was eighty-four days at sea out of the first ninety-five days of the war. After some months Sub-Lieutenant McAndrew and Sub-Lieutenant Muir were both recommended for promotion to lieutenant. This recommendation came to the notice of the then First Lord of the Admiralty, Mr. Winston Churchill, who wrote across the recommendation: "Promote them, age will be served."

As they would have wished, they died together in the service of their country when the little *Campeador V* was destroyed by a mine on June 23, 1940, leaving to their countrymen the memory of an inspiring example.

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INTERIOR OF A 16-IN. GUN TURRET

Gun crews at work in the gun house of a triple 16-in. gun turret. The cordite and shells are delivered to the breech by the hoist seen in the foreground and loading is done by machinery

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CHAPTER 11

Gunnery in the Royal Navy

Gunnery personnel. The gunnery officer. The gunner's mate. The gun armament. Power-worked guns. The naval gunnery problem. Unstable platform. Ballistics. Spotting and range-keeping. Movement of ships. Avoiding action. Use of aircraft. The transmitting station. Night attack. Searchlights and star shell. A.A. attack. Ships versus aircraft

Si vis pacem para bellum (If you wish for peace, prepare for war). Such is the motto of H.M.S. *Excellent*, otherwise Whale Island, the home of naval gunnery at Portsmouth. It is blazoned in large letters over the West Battery. Few will deny that generations of gunnery officers, in full knowledge that the gun is the final arbiter in naval battle, have laboured to give effect to this motto.

It is impossible in the space of this chapter to include a history of gunnery; that would fill a whole book. It is interesting to note, however, that there was a long period after the transition from sail to steam when the problem of hitting the enemy under modern conditions was not seriously tackled. It was not until 1904, when special trials were carried out by H.M.S. *Venerable*, that controlled firings at longer ranges were proved to be practicable. A new vista of naval gunnery was opened up, and the whole of the gunnery world came to appreciate the importance of the task before them.

WAR EXPERIENCE

During the years preceding the war of 1914-18, great strides were made. While naval actions of that war gave evidence that we had been working on sound lines, the realism of battle showed up several weaknesses. As an example, we may quote the failure of our armour-piercing shells to penetrate the vitals of an enemy's ship before bursting. Nor had we given sufficient attention to the anti-flash arrangements intended to prevent the explosion of the enemy's shells igniting our cordite charges when en route to the guns. This oversight led to explosions in the magazines and the loss of more than one ship. Both these matters were put right before the end of the war of 1914-18.

FIRE CONTROL

As regards fire control, experience showed that the correction of fire, when both the firing ship and her target were moving at full speed, was a very different thing from engaging a slow-moving target; and that, when a large number of ships were engaged in a restricted area, smoke from the funnels, guns and explosions reduced the visibility, even on the clearest day, and made observation of fire extremely difficult. All the hard-won experience obtained in actual battle was studied and carefully applied to the gunnery technique.

There is an old saying that "It is the man behind the gun that counts," and although in a war of machines it has been proved, time and again, that flesh and blood and sheer bravery are of small account if modern war machines are not available, the old adage still holds good in duels with up-to-date material.

Whatever criticisms can be levelled at the lean years when our fighting Services

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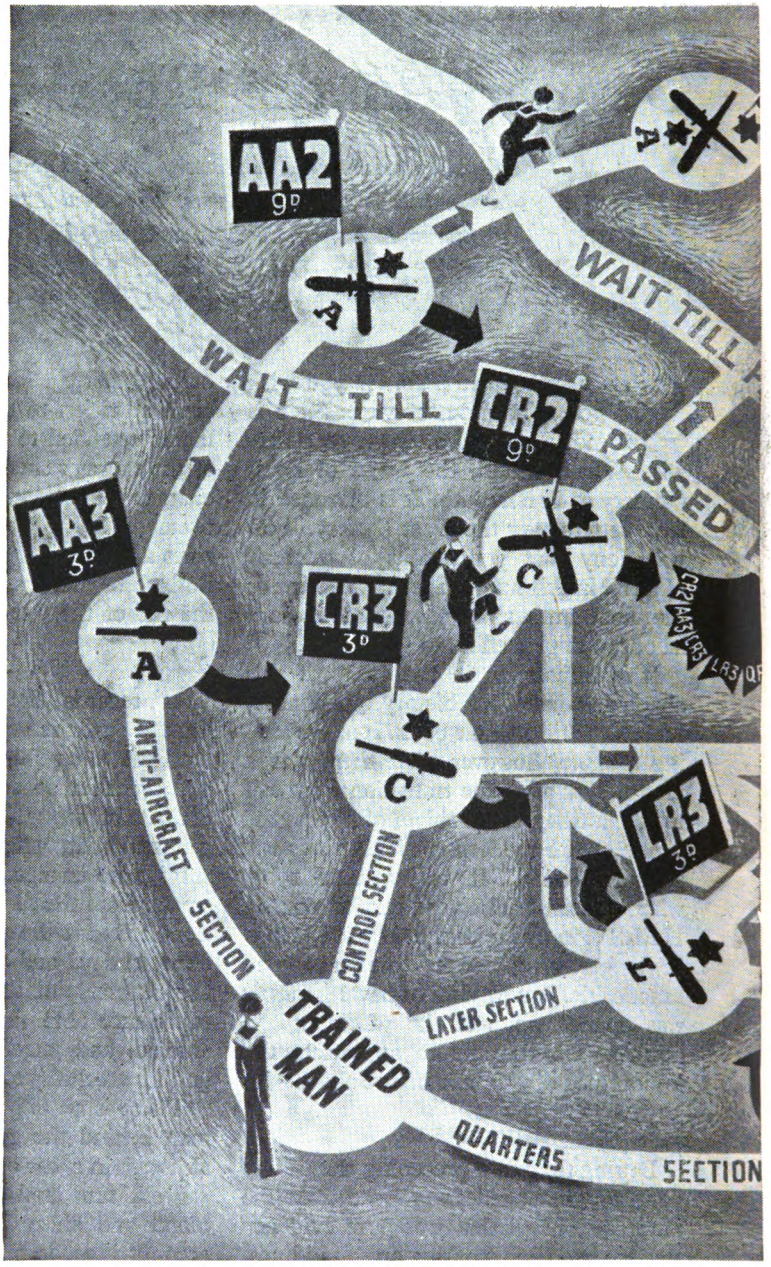
were starved of material in the interests of economy, and in the belief that another major war would never occur, the Navy perhaps suffered the least; for we never relaxed the training of the gunnery personnel or our efforts to develop the brand - new cult of anti-aircraft gunnery.

The personnel of the Royal Navy consists, broadly speaking, of the seaman branch and Royal Marines, the engine-room department, communication branch (visual wireless telegraph) and the artificer and artisan branches. All have some functions to perform on the "quarter bill," such as the stations of the ship's company for action.

The gunnery officer is responsible directly to the captain for the stationing of the ship's company on the quarter bill and for the



SUCCESSIVE STAGES OF A MAN'S

Fig. 1. *Specialized training for gunnery ratings is divided into four main sections, as shown above. In the white circles, which represent the successive stages in a man's career, the badges which he wears on his right arm are shown; the flags indicate his rate, together with the*

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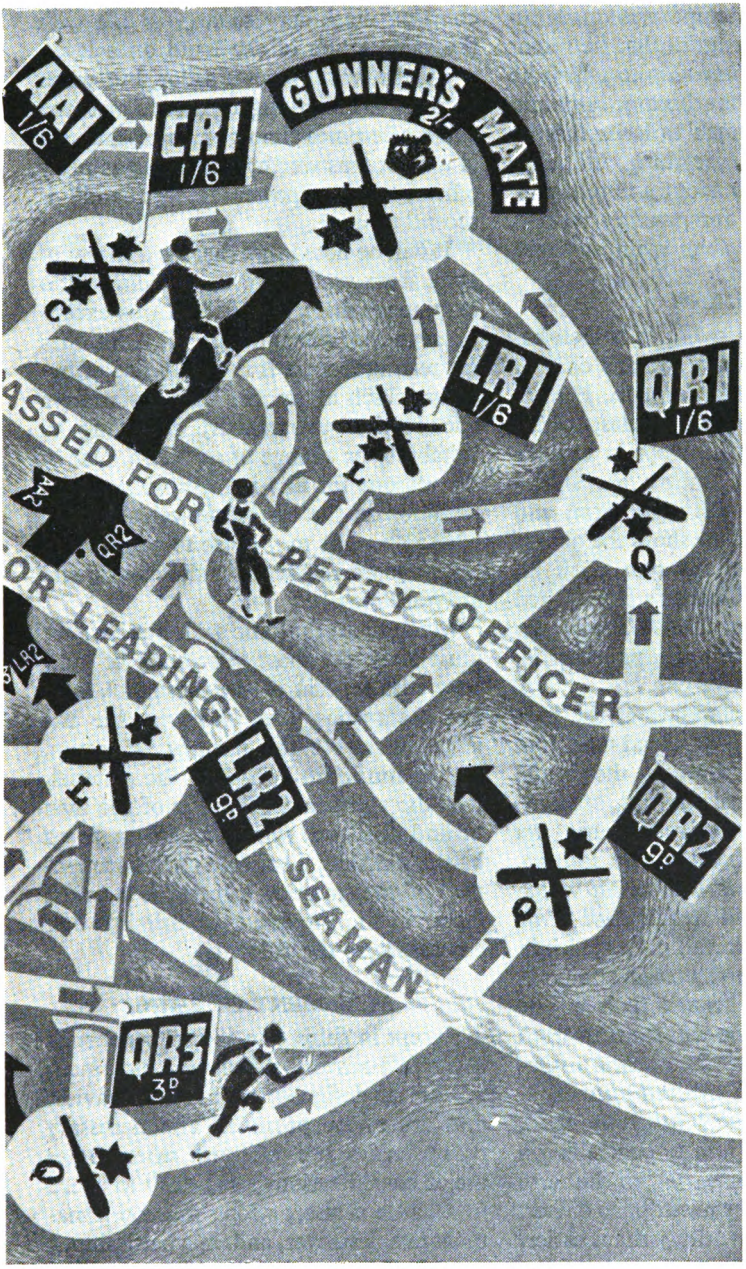

GUNNERY CAREER IN THE ROYAL NAVY

extra pay per day that each rate carries. The arrows on the circles show how men of exceptional ability can take a short cut to the rate of gunner's mate. There are also bypaths which allow men to transfer from one main section to another, if it is better that they should do so

gunnery efficiency of the ship. First of all, he must be a leader, in order that all other officers in direct command of the various quarters, such as turrets, secondary armament, A.A. armament, fire control, etc., become his willing assistants.

Next, he must be an expert in every sense of the word in all gunnery technical matters, including hydraulic machinery and the ten calibres of guns in use in the Royal Navy, from the 16-in. down to the 3-in. He must also know the multiple pom-pom and machine guns, rifles and pistols, for a part of the seaman's training is devoted to fitting him to fight on shore.

Under the direct supervision of the gunnery officer is a large band of gunnery specialist ratings. Until recently, a man who decided to join the gunnery branch became a seaman

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gunner; and an attempt was made to train him in all the duties that he might have to perform in any ship to which he might be sent. It soon became apparent that there was so much to learn that he could not be taught everything, and it has become necessary to adopt a much more specialized training for gunnery ratings, dividing them into four main sections.

TRAINING

These are shown in Fig. 1, which has been produced specially for this chapter by the courtesy of the captain, H.M.S. *Excellent*. In the white circles, which represent the successive steps in a man's gunnery career, the badges are shown which he wears on his right arm; and each circle is flagged to show the abbreviated designation of his rate, such as, "QR3" signifying "Quarter's Rating, 3rd Class." On the flags is also shown the extra pay per day that the rate carries, called "non-substantive pay."

The young man standing at the left-hand bottom corner is a trained man, that is, he has passed through the initial courses in professional subjects, seamanship, gunnery and torpedo, that are required before he is rated able seaman. The young seaman is wondering which gunnery path he will tread. Shall it be along the new anti-aircraft path, which in these days is of ever-increasing importance, or along the control path or the layer's path, where he will learn to work a rangefinder and other fire-control instruments required with modern gunnery?

Though less spectacular than the A.A., this route may lead him to controlling a part of the armament, a job hitherto looked upon as the perquisite of an officer. Finally, he may choose the perhaps easier, but none the less essential, path of the quarter's section, the men who load the guns and specialize in working hydraulic or electrical machines. There are many worse jobs than causing powerful and complex machinery to leap to life with the mere touch of the hand on a lever.

All the world loves a sailor, but when it comes to describing a gunner's mate the subject becomes almost embarrassing. He is a most trustworthy and efficient petty officer, whose "power of command" is second to none.

It will be noted that there is a short cut open from 2nd and even 3rd class rates to gunner's mate, travelled only by exceptional men of outstanding ability. Another interesting feature is the existence of by-paths which allow men to transfer from one section to another, according to suitability or change of ambition. One of the reasons for this is to provide a continuation in the careers of valuable men whose eyesight may cease to come up to the standard required for the control and layer sections.

Much more could be said, but here we must leave the most interesting of gunnery studies, that of the personnel, with the observation that however fine the ships, whatever the strategy or tactics, and within limits, whatever the material, it is the spirit and efficiency of the man behind the gun which counts in a sea battle. And the discipline and thoroughness of the gunnery training is a prime factor in the moulding of Britain's best ambassador—the sailor.

ARMAMENT OF SHIPS

Except in ships of a special type, such as aircraft carriers, minelayers, etc., men-of-war are designed to carry the heaviest gun armament possible. The necessary compromises are effected when other major considerations arise, such as speed in a battle cruiser, strong torpedo armament in a destroyer, and, in a battleship, a considerable percentage of her weight must be given up to armour protection so that she can withstand punishment from guns of the same calibre as she herself carries. This percentage has increased

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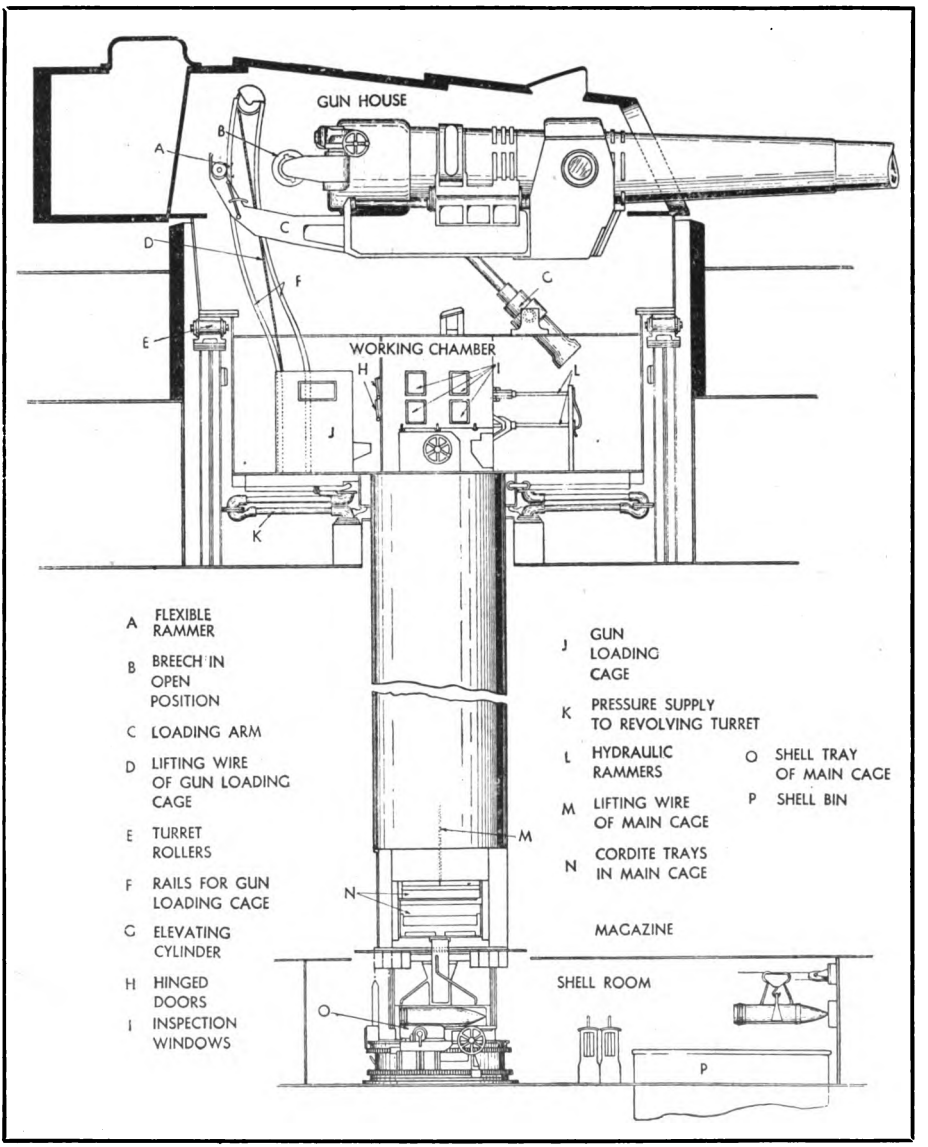
enormously of recent years, owing to the vital requirement of a bomb-proof deck against high elevation bombing by modern aircraft with armour-piercing bombs fitted with delay-action fuzes.

Fig. 2 shows H.M.S. *Rodney* and the main features of the gun armament and control positions, the latter being mostly contained in the large superstructure which carries the bridges and is flippantly



HOW A 15-IN. GUN TURRET WORKS

Sectional diagram illustrating the layout and main features of a typical 15-in. gun turret. The shells are delivered from the shell room to the breech by power-operated hoists

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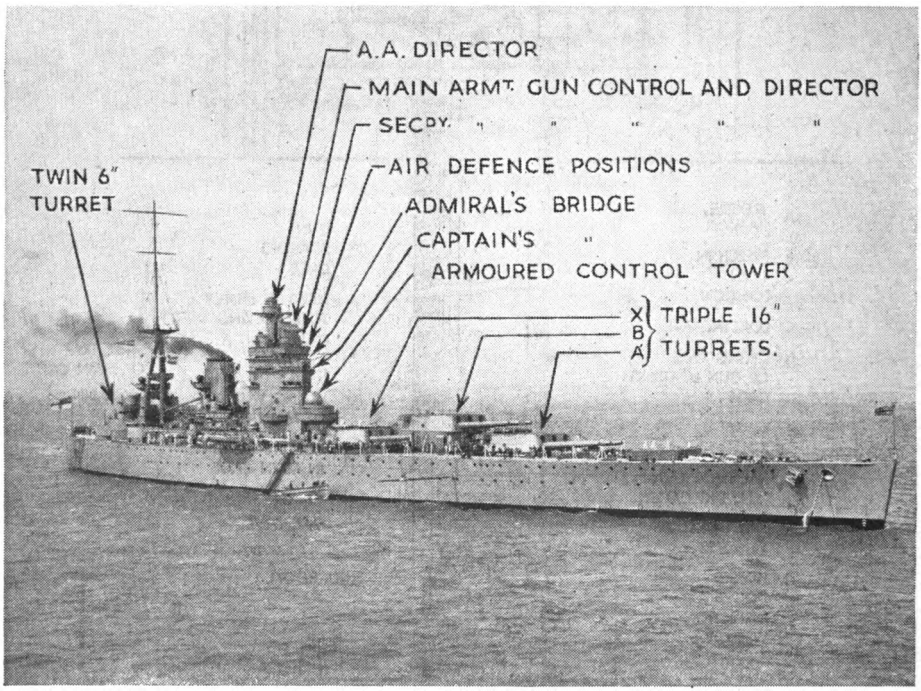
called "Queen Anne's Mansions" or "Peabody Building" according to choice. In addition, important gun-control positions and directors are duplicated in the after part of the ship.

The words "naval gun" have always been synonymous with a gun of great power and high velocity, the latter being necessary not only for the long ranges of naval battle but also to obtain a high striking velocity for penetrating armour. The walls of the shell have to be so strong for this purpose that a comparatively small percentage of the total weight of the shell is available for the bursting charge, which leads again to the demand for bigger guns. Very heavy guns are, however, comparatively easily arranged for in ships, where there is plenty of power available to work them. The British Navy operates them with hydraulic power.

Power-worked guns vary in size from 16-in. in H.M.S. *Nelson* to the 8-in. guns of heavy cruisers. Secondary armaments of heavy ships and main armaments of smaller cruisers, destroyers, etc., are hand-loaded guns; the heaviest projectile practicable for continuous loading being the 100-lb. projectile of the handy 6-in. gun, which has quite a good penetration against lightly armoured ships. Hand-worked guns are often mounted in pairs or triple turrets when they have power training and elevating gears, and the supply to hand-worked guns is almost invariably by power-worked hoists.

A recent gun now much in use is the 5.25-in., generally a combined high-angle



GUN ARMAMENT AND CONTROL POSITIONS OF H.M.S. RODNEY

Fig. 2. *The control and director positions are mostly situated high up in the large superstructure which carries the bridges. They are placed high so as to be clear of interference from spray or smoke. Important gun-control positions and directors are duplicated in the after part of the ship, but the main control tower is clearly seen to be the nerve-centre of a battleship*

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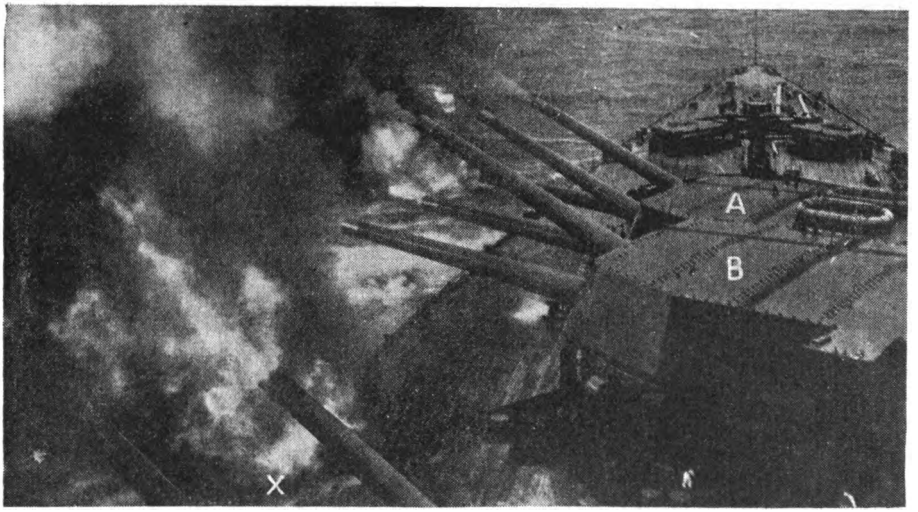

ALTERNATIVE FIVE- AND FOUR-GUN SALVOES

Fig. 3. *Ships in action fire salvoes with half the broadside in each salvo. (Above) The two outer guns of* A *and* X *turrets and the centre gun of* B *turret have just fired. The centre guns of* A *and* X *and the outer guns of* B *are in the loading position getting ready for the next salvo*

and low-angle gun, firing the heaviest shell that can be conveniently used for anti-aircraft work. These guns are mounted in the new small cruisers, and as a secondary armament of battleships. Destroyers are armed with 4.7-in. hand-loaded guns and have a separate A.A. armament, but escort destroyers carry a combined high-angle and low-angle armament of 4-in.

As will be explained later in this chapter, a ship in action, in order to be able to observe her fire and correct it on to the enemy ship, fires her armament in salvoes with half the broadside in each salvo. If the main armament is contained in pair-gun turrets (all earlier ships than H.M.S. *Rodney*), one gun in each turret fires in each salvo. In H.M.S. *Rodney*, where the armament consists of nine 16-in. guns in three triple turrets, salvoes must consist of an unequal number of guns, five or four. Fig. 3 shows a salvo of five just fired, with four guns in the fixed loading position which will elevate to the firing position as the guns just fired depress to reload.

The problem that naval gunnery has to solve is how from an unstable platform moving at high speed to direct the gunfire on an enemy ship with sufficient accuracy to hit her first, to hit her hard, and to go on hitting her.

To hit her first entails an almost instant readiness to open fire whenever a ship is at sea in wartime. Apart from any warning that may be given by aerial observation, on the finest day there may be a smudge of smoke on the horizon. The ship turns towards it and increases to full speed, with the enemy (if it proves to be so) doing the same; and such is the speed of ships today, and such are the ranges of which modern guns are capable, that it is only a matter of minutes before action is joined. Such, exactly was the experience of H.M.S. *Galatea* in the opening phase of the Battle of Jutland. A more striking example is the case of H.M.S. *Exeter* which, at the Battle of the River Plate, was in action against the *Admiral Graf Spee* two minutes after turning out of the line to investigate smoke on the distant horizon.

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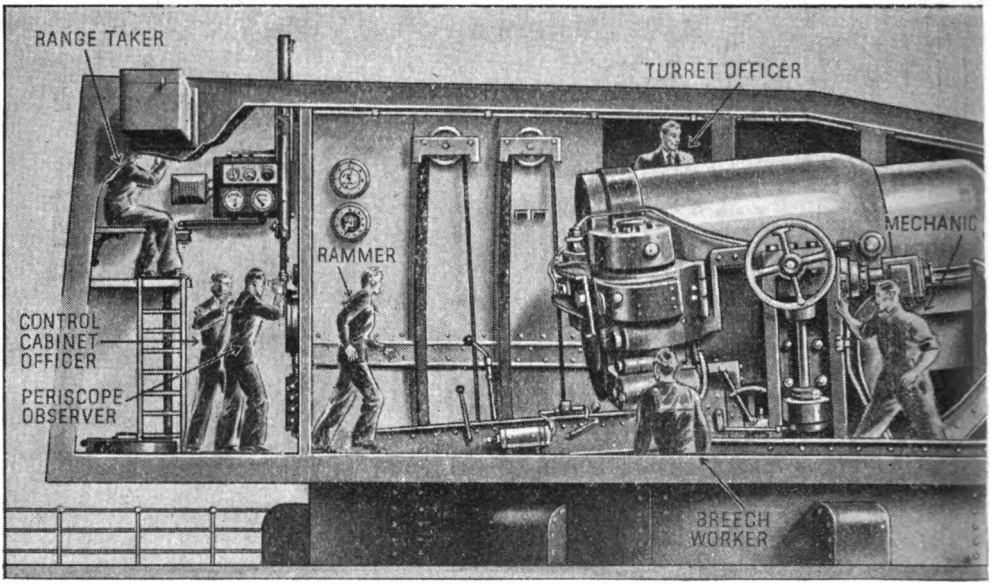

SECTIONAL DRAWING OF THE INTERIOR OF A GUN HOUSE, SHOWING

General view of the interior of the gun house of a triple 16-in. gun turret. Each gun fires a shell weighing 2,461 pounds—over a ton—for a maximum distance of 35,000 yards,

During this brief interval, cool heads must take the necessary observations and set the machinery of modern fire-control in action, and be ready to open fire instantly on the captain's order. In low visibility or at night, opponents will be within range before they sight one another, and the guns and fire-control must be kept manned so as to open fire the instant an enemy is sighted.

This opening phase of a modern sea battle is, perhaps, the most testing of all, when all excitement must be overcome and the whole gunnery machine, galvanized suddenly into life, must work smoothly and efficiently. The easier way, that of starting badly and then settling down, will not do. The captain of the German cruiser *Emden* complained bitterly, after his defeat by H.M.A.S. *Sydney*, that the hitting of his rangefinders and the upsetting of his fire control by one of the early salvoes was good luck for H.M.A.S. *Sydney*. This may be so, but it is the same luck as attends the long putt holed—the greater the skill with which the shot is played, the more likely "luck" will result.

To hit the enemy hard entails the maximum output directly the range is found, and maximum output means that all guns that bear should fire with clockwork precision in every salvo, with no fumbling in the loading drill, or hitches in the ammunition supply, no incorrect setting or reading of the many fire-control instruments, no aiming errors, and all guns laid and trained with an accuracy of seconds of arc.

An amusing story is told of the Battle of Jutland, where a battleship armed with ten guns caught only a momentary glimpse of the enemy and fired two salvoes. The first, of five guns, fired correctly. The second, however, consisted of only four guns and, immediately it had fired, the "cease fire" gong rang. The gunlayer of the gun which had missed fire came down from his seat to find out what was wrong,

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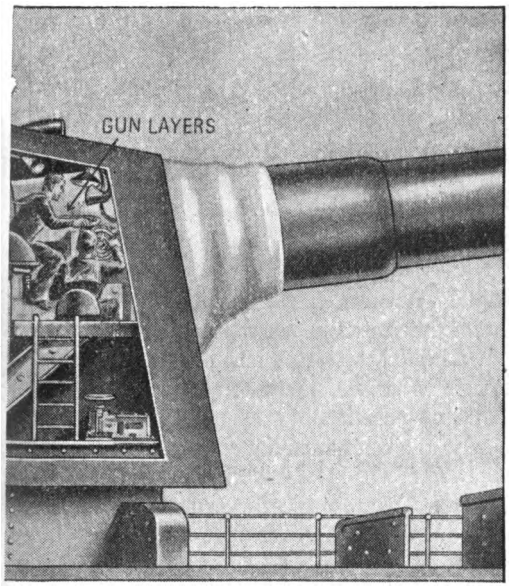

THE POSITION OF THE CREW

nearly twenty miles. The guns have a maximum elevation of about forty degrees

and discovered that the "No. 2" of the gun, in his excitement, had failed to close the interceptor switch (the last operation of loading) which completes the director-firing circuit. The gunlayer said: "I have waited for two —— years to hear this —— gun fired at the enemy, and you forgot to ——," the rest of his sentence being drowned in a process of rough justice which left No. 2 a minor, and the only, casualty in the ship.

To go on hitting is the hardest of all. No one likes being hit, and a ship at sea, having freedom of movement, will, like a boxer, endeavour to avoid punishment by dodging and side-stepping. Therefore, the process known as "keeping the range" is one that requires the highest vigilance and a notable standard of efficiency.

If you were to ask a land gunner what he would think if his gun platform started to rock some 10 degrees and at the same time to twist right and left through some 3 or 4 degrees, and to vibrate with some violence, his reply would give some indication of a condition which the Navy must consider an everyday occurrence. The enemy is, however, in the same plight, and a consideration always to be borne in mind by a captain or admiral when accepting action, is to do so on a course which will give the enemy the worst conditions of roll, spray, smoke or light, while ameliorating those conditions for his own ships. This is no easy task and the ability to achieve it results from experience.

Frequently it is impossible to give effect to such a choice, as often there is some over-riding tactical or strategical consideration, such as the position of the enemy or objectives that he or you may have in view. The Battle of Coronel, however, provided an example, when von Spee delayed action till his ships, the *Scharnhorst* and the *Gneisenau*, could engage Admiral Cradock with H.M.S. *Good Hope* and *Monmouth* silhouetted against the setting sun and in unfavourable spray conditions in a rough sea, while von Spee's own ships were almost invisible and unhampered by spray.

The normal way of firing guns in these days is by means of what is called a director. This is a dummy sight placed usually high up so as to be above the ship's smoke and to obtain a clear all round view. Its position in elevation and direction is automatically telegraphed to every gun position, where the gunlayers elevate and train the guns in accordance with the signals received. The guns, therefore, are always laid and kept laid on the object at which the director is pointing. When the director-layer's telescope is on the target, he presses a master trigger which fires all guns which have been loaded and brought to the ready.

In order to get a proper knowledge of the problem which confronts the naval gunner, one should understand certain terms used in external ballistics, that is, during the flight of the projectile (Fig. 4).

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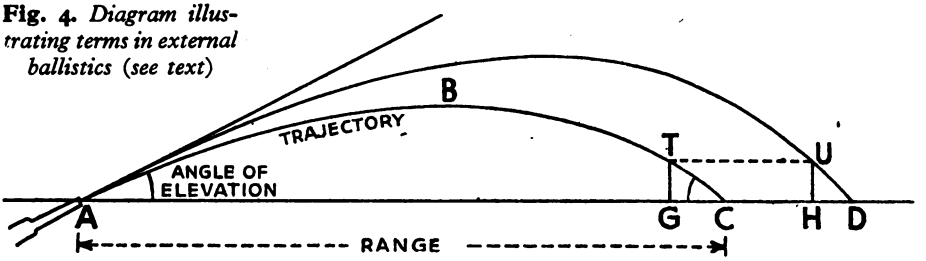

Fig. 4. *Diagram illustrating terms in external ballistics (see text)*

If a gun is fired at A, the angle between the bore and the horizontal is called the "angle of elevation" of the gun. The projectile is rammed into the gun until the soft copper driving-band jams in the commencement of the rifling—grooves cut in the inner tube of the gun in order to give the projectile a spin while in the air and keep it travelling point first. On the charge being fired, the projectile is forced along the bore by the expanding gases of combustion at ever-increasing velocity, and its velocity on leaving the muzzle is called the "muzzle velocity."

As soon as the projectile is in the air, the resistance of the air begins to reduce this velocity, and continues to do so during the whole time it is in the air, which is called the "time of flight." Gravity also exerts its force on the flying projectile, pulling it back to the horizontal, so that it actually describes a path called the "trajectory," shown in the diagram as A B C. It should be noted that, as the velocity gets less, gravity pulls the projectile back to earth at an ever-steepening angle. The projectile strikes the water at C. The horizontal distance it has travelled, A C, is called the range, and the velocity at which it strikes the water is called the "striking velocity."

The angle at which the projectile strikes the water, A C B, is called the "angle of descent." If the projectile just grazed the top of a vertical target, T G, at T, and if the height of the target is known, then the distance G C can be found. This distance is a very important one and is called "the danger space," since any shot falling in it will have gone through the target.

The danger space lies between the limits within which the range must be known to obtain a hit with a gun of perfect accuracy. It will be noted that, at a longer range, since the angle of descent is steeper, a target of the same height, U H, will have a smaller danger space, H D.

The hull of a ship has breadth as well as height. In Fig. 5 the hull of the *Graf Spee* is shown, height twenty-five feet, breadth seventy feet. A shot fired from an 8-in. gun at a range giving an

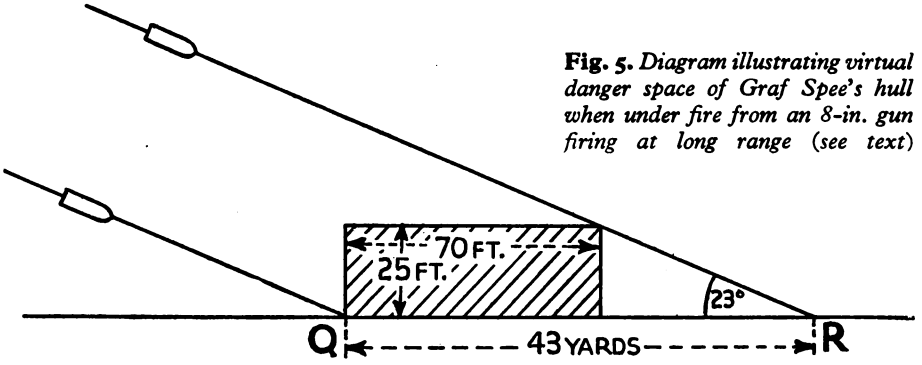

Fig. 5. *Diagram illustrating virtual danger space of Graf Spee's hull when under fire from an 8-in. gun firing at long range (see text)*

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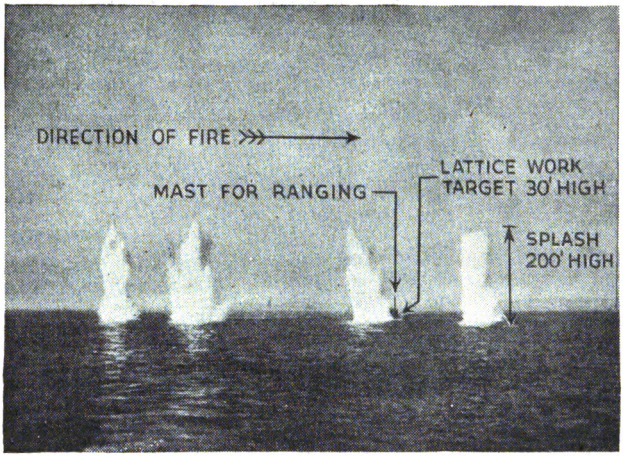
angle of descent of 23 degrees would hit the hull of the *Graf Spee* if it was going to fall less than forty-three yards over. The distance Q R is called the virtual danger space.

When the muzzle velocity of the gun for any given angle of elevation has been determined, the trajectory can be calculated, and tables called "range tables" are made out, giving for every 100 yards of range the angle of elevation, time of flight, angle of descent and striking velocity, and other details which need not concern us here. The one thing that cannot be calculated beforehand is the accuracy of the gun, for it must be realized that a number of rounds, perfectly laid, do not fall in the same spot. The accuracy is found after the gun is made by firing a large number of rounds from a new gun mounted on shore.

Casting theory aside, however, what really does interest the gunner, in practice, is that (if all avoidable errors are eliminated by careful adjustment and good drill, and allowance is made to each individual gun for the fall of muzzle velocity due to wear) when a ship fires a broadside the distance between the farthest shot and the nearest shot, called the "spread of the salvo," should be fairly constant.

Typical spreads are shown in Figs. 6, 7 and 8. The spread is watched and checked at all practice firings during the whole life of the ship; and on the knowledge of the spread, and on the ability to keep it comparatively small, the ability of the ships to hit the enemy depends.

It is important to realize why this is. Naval shells are fuzed with delay-action fuzes, which are set in action on hitting a ship, whether on a thin plate or on armour, and the shell bursts well inside the ship. Such a hit cannot be seen. Neither can misses "over" be seen in battle, owing to smoke from the enemy's guns, funnel smoke, and other causes. All that can be reasonably hoped for is to be able to see splashes that fall short of the enemy and in line with her, and these can be counted and used as guides.



SPREAD OF THE SALVO

Fig. 6. *When a ship fires, the distance between the farthest and the nearest shot is known as the spread. The picture above shows a salvo that has successfully straddled the target with two short, one possible waterline hit and one miss over*

If all are short, the range must be increased to hit. If nothing is seen at the end of the time of flight, some may have hit, but there is no certainty that all are not misses over. So what must be aimed at is to have a certain percentage of short shot in every salvo, and hope that some or all of those not seen are hitting. This is called a "straddle" (*see* Fig. 7). Straddles are not necessarily hitting salvoes. The German cruiser *Königsberg*, in the Rufiji River (1914), straddled the monitor *Severn* for a very long time without scoring a hit.

Actually, shot fall irregularly within the spread, which is sometimes larger,

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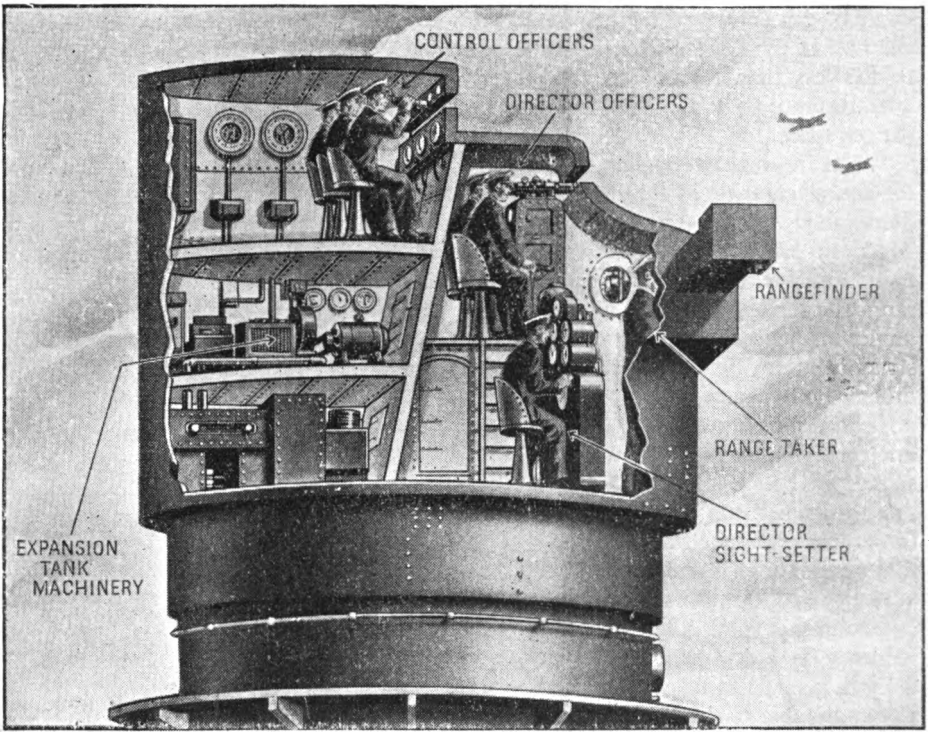

CONTROL OF A BATTLESHIP

Here the position of the target is found and passed on to the transmitting room, where ranges taken from the turrets are also received. The mean range is then worked out and transmitted to the control tower. When all guns are ready, they are fired by the director layer

sometimes smaller, as seen from Fig. 6. It is not unreasonable to assume that if one of the rounds is kept short, approximately forty per cent of straddling salvoes may obtain a hit on the hull, provided no error exists or is made which increases the spread. It is evident that the smaller the spread, the more likelihood there is of a straddle containing a hit. H.M.S. *Exeter*, which engaged the *Graf Spee*, fired only three-gun salvoes, and the chance of hitting was correspondingly reduced.

The method of correcting the fire at sea to hit the enemy is called "spotting." Reference has already been made to certain difficulties. Apart from artificial ones such as smoke, etc., the great ranges at which naval actions are sometimes fought make it impossible for an observer in a ship to judge by how much a salvo is short or over the enemy; and, if the splash is not in line with the target, it is impossible to be sure whether the salvo is short or over. It is, therefore, the invariable rule to correct for direction before spotting for range, unless aircraft observation is available to render assistance.

If both the firing ship and the enemy were stationary, it would only be necessary to take a range of the enemy, fire, correct for direction and then for range till the correct percentage of shot was seen short, and then develop a high rate of fire. In principle, that is what the Navy does. But a tremendous complication is introduced by the fact that both ships are

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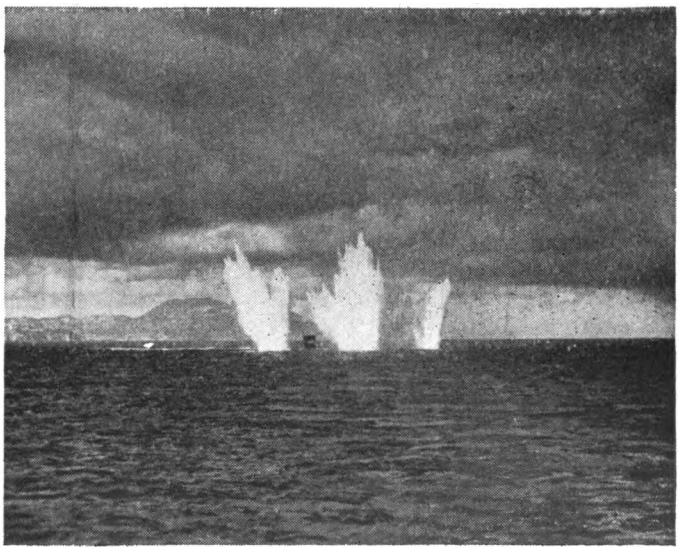
moving at high speed, so that the range is changing from second to second, and a range taken at any moment is out of date before it can be set on the director and the guns fired.

Moreover, the enemy may change her position appreciably while the shots are in the air, say thirty or forty seconds. Before the guns are loaded and fired again, the range is again something entirely different. The amount by which the range is changing, either opening or closing, is called the "rate of change of range," for short the "rate"; this is computed in yards per minute by setting an instrument called the "dumaresq," or some development of it, with the ship's own known course and speed, the bearing of the enemy, and his *estimated* course and speed, as judged by eye or measured by an instrument called the "inclinometer."

It is to be noted, however, that the enemy's course and speed are rarely known exactly. If a ship is coming nearly towards you, her course may be judged within narrow limits, but if she is steaming across the line of sight it is difficult to judge her course exactly and her speed is a matter of guesswork. If the enemy's course is judged wrongly, then the "rate" in use will be wrong and the shots will wander away from her, and continuous spotting will be necessary to get them back.

Something of the sort is happening in the shoot shown in Fig. 8. The firing ship has here started with two straddles, but salvoes 3, 5 and 6 are all short. After a period of straddling No. 9 is again all short, and shots are on the short side for the remainder of the shoot. Too great a "closing rate" has been applied. Points to notice are that, though the length of the spread is fairly constant, it is, so to speak, "concertina'd," sometimes smaller, sometimes larger, and the fall of shot are not equally spaced, and occasionally several shots fall very close together.

On the other hand, there are instances where ships have been hit by several shells in one salvo. Too small a spread may be a disadvantage from the spotting point of view, because it is then very difficult to get really accurate observation of the straddles. Either all are short or all are "not seen," and the chance of the "all not seen" being hits is small. Continuous spotting is therefore very necessary to keep the salvoes effectively crossing the target.



STRADDLING THE TARGET

Fig. 7. *A target is "straddled" when shells from a salvo fall on either side of it. Gunnery officers try to get a certain percentage of a salvo short, because shots that fall beyond the target cannot be observed. (Above) This straddle is almost ideal. Reading from the right, there are one short, one probable, one certain, one possible*

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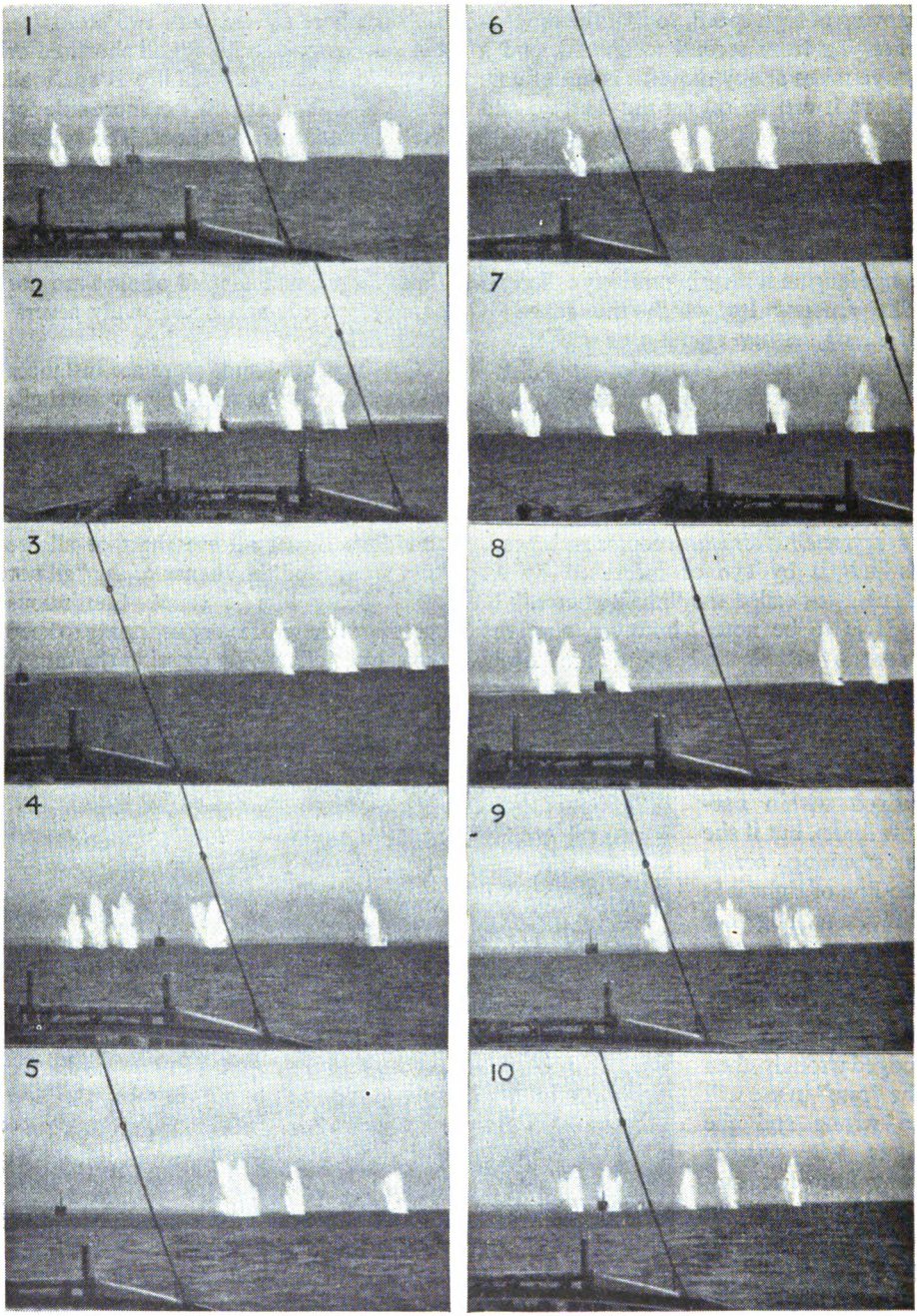

← DIRECTION IN WHICH THE GUNS OF THE SHIP

The above series of photographs indicates the process of ranging of a ship's guns. Further

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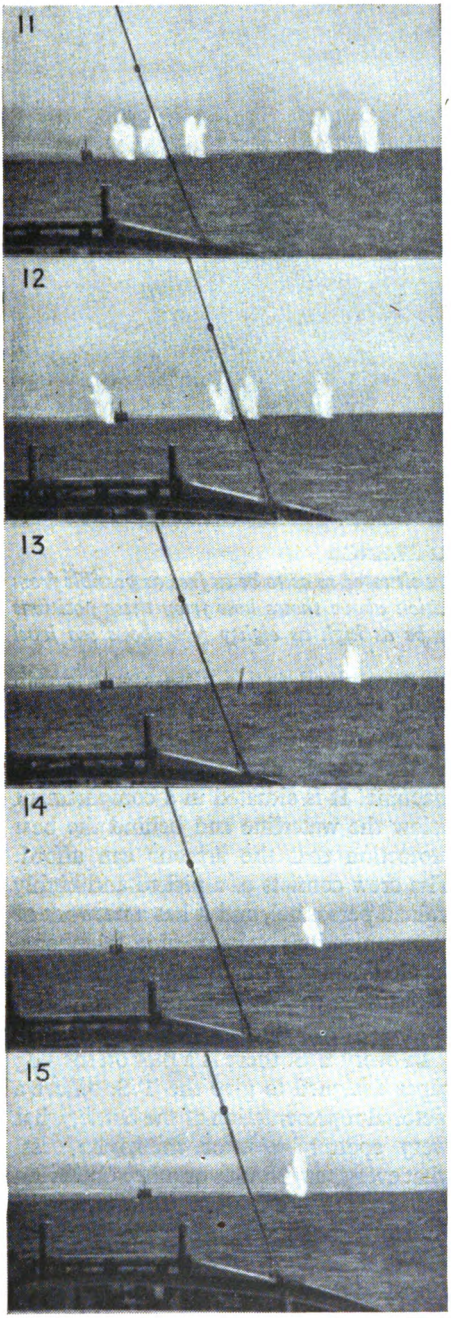

AT TARGET PRACTICE ARE FIRING
comment is to be found in the caption on right

The ability to take avoiding action to avoid punishment is made full use of by opponents in a sea fight. A cunning captain, by watching the fall of enemy's shot, would jink his ship about and stand little chance of being hit. In long-range actions between heavy ships, it is common practice to zigzag, that is, make unobtrusive and irregular alterations towards and away from the enemy, so that he is continually caused to miss and refind the range. Thus the greatest vigilance is required in watching the enemy's every movement and allowing for it.

It is most desirable that spotting officers should be as comfortable as possible and their positions free as may be from blast, funnel and cordite smoke, and spray. Figs. 9 and 10 show how the aloft position sees over smoke and spray.

Obviously, the higher the spotter can get the better. Trials were carried out after the war of 1914-18 of using aircraft to carry the spotters. Generally, aircraft of the Naval Air Arm carried in aircraft carriers, which accompany the fleet to sea, have other roles to perform—reconnaissance and offence—and it is usual for those used for gunnery observation to be carried in the fighting ships themselves; they are catapulted before action begins, since the fragile craft are very vulnerable to damage from gun blast. In the Battle of the River Plate, the action started so suddenly that the aircraft from H.M.S. *Ajax* was precariously, but successfully, sent into the air with the guns firing.

Still more valuable information can be obtained by aircraft observation, namely, watching an enemy's white wake. Any

VARIATIONS IN RANGE

Fig. 8. *Firing at a target. After starting off with two "straddles," salvoes 3, 5 and 6 have fallen short. After straddling the target once more, No. 9 is again short and the shots are on the short side for the remainder of the shoot because too great a closing rate has been applied. The space between shots varies*

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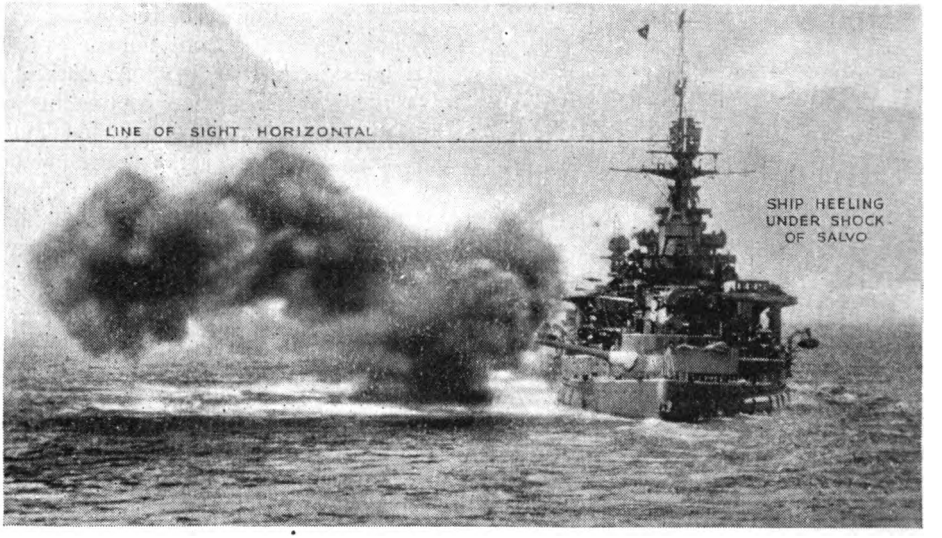

SMOKE INTERFERENCE

Fig. 9. *The fire control positions on a battleship are situated so as to be as free as possible from blast, and funnel and cordite smoke. The illustration above shows how from these positions aloft it is possible to see over smoke. They may be as high as eighty feet above sea level*

alteration of course is then visible, and instant reports of enemy's alterations are more valuable than reports of fall of shot. The aircraft must, of course, keep away from enemy A.A. guns, which makes observation not so easy as it sounds.

So valuable is air observation to the gunnery organization that it is most important to gain command of the air over a surface engagement, so as to have the advantage of aerial observation and deny that facility to the enemy. This is the job of the fighter aircraft in aircraft carriers.

It is obvious that each spotter must be able to pick out his own fall of shot from the welter of stuff falling around an enemy ship. The time of flight given in the range tables is then of great importance. A stop watch can be started as the salvo fires, and the hand will point to the time of flight at the moment when the shot is due to fall. In practice, an instrument is provided, which is kept set for range, and which hoots at the instant the shot is due to fall, so that the spotting officer can keep his eyes glued to his glasses and is told orally which is his own particular shot.

The transmitting station, or T.S., is the nerve centre of the gunnery machine. It is situated in a compartment below the waterline and behind the best protection that the armour can afford. The crew consists of a picked and highly trained personnel, and it has a network of communications by voice-pipe, telephone, or electrical visual transmitting instruments with the spotting positions, guns, directors, rangefinders, etc.

In every T.S. there is a plot on moving paper designed to give the T.S. officer a pictorial representation of the battle, what every spotter sees, or thinks he sees, what every rangefinder or other observing instrument records. The T.S. officer is, therefore, in a position to view the accuracy of all reports as a whole, advise the control officer when in doubt, or even correct the fire on to the enemy himself. But not always; a gun control officer, usually the gunnery officer, must be able,

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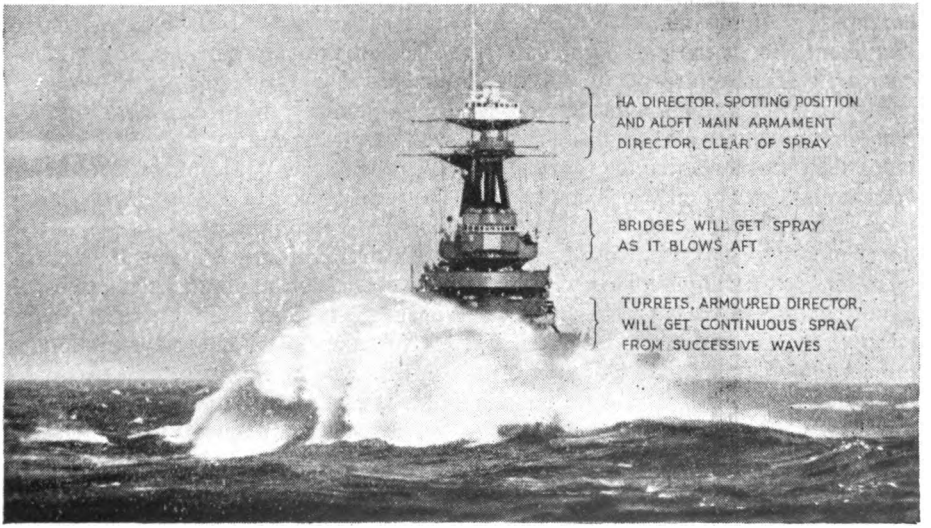
for obvious reasons, to over-ride decisions whenever things go wrong during a shoot.

Of all the aspects of naval gunnery, perhaps the art of night fighting is the most exacting. The problem of hitting first becomes paramount, and the ability to do so before the other fellow is probably decisive. Ships meeting at night are normally within decisive gun range on sighting, the range being so short that only the thickest armour can afford protection, and trajectories are so flat that a large percentage of hits can be expected from a salvo fired with the correct range. A weaker or numerically inferior force well skilled in night fighting may well score a success over a stronger opponent less well skilled in night fighting.

The first requirement is sharp eyesight. But even sharp eyes must be given the best conditions, and much care and thought are given to training special look-outs, making them as comfortable as may be, providing them with the best glasses that our manufacturers can produce, and seeing that they have short "tricks," that is, that men are not required to strain their eyes for too long at a time.

The watchword of night action has been dubbed "ipomo," that is, the "instantaneous production of maximum output," and a classic example of how well this watchword has been applied exists in the night action in the Battle of Matapan. In the day action, the Italian cruiser, *Pola*, had been disabled by attacks of the Naval Air Arm. After dark, three Italian cruisers were approaching the damaged *Pola* on a course roughly south-west, and no doubt their eyes were strained ahead to sight her. The battleships H.M.S. *Warspite*, *Barham* and *Valiant*, with screening destroyers, were approaching the same spot on a course roughly north-west, and sighted the line of Italian ships on the starboard bow crossing from starboard to port. Thus our ships had the priceless advantage of a view of ships broadside on, while themselves presenting almost an end-on view to the enemy, and we appear to have


HA DIRECTOR, SPOTTING POSITION AND ALOFT MAIN ARMAMENT DIRECTOR, CLEAR OF SPRAY
BRIDGES WILL GET SPRAY AS IT BLOWS AFT
TURRETS, ARMOURED DIRECTOR, WILL GET CONTINUOUS SPRAY FROM SUCCESSIVE WAVES

SPRAY INTERFERENCE

Fig. 10. *By placing the main control positions high up in a battleship, not only is interference from the smoke of the guns avoided, but the range of vision of the control tower personnel is clear of spray. This is a vital matter when finding the range of enemy ships during an action*

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sighted first. What followed, however, was not chance; for, when the enemy were suddenly illuminated by the searchlight of the destroyer H.M.S. *Greyhound*, two 8-in. Italian cruisers of the *Zara* class received the instantaneous production of maximum output from the battleships, and were obliterated without being able to reply.

FIRING AT NIGHT

In night action, it is necessary to illuminate the enemy in order that the guns may be aimed and also to see the splashes and be able to correct the fire. There are two means of illumination in general use, the searchlight and the star shell, the latter being a time-fuzed shell fired at a high angle of elevation, generally from the A.A. guns, the fuze being set to burst the shell high in the air behind the enemy, releasing a parachute flare very similar to the flares used by German aircraft in night attacks on this country. Both illuminants have advantages and disadvantages.

The searchlight has the advantage that illumination is instantaneous, and it dazzles the enemy and neutralizes his illuminant. But it can only illuminate at comparatively short range; it affords a good aiming mark for the enemy and he can take its range; also a ship burning searchlights is silhouetted to other enemy vessels on different bearings. They are not good in drizzle nor when there is smoke interference, as any one will appreciate who has used headlights when driving a motor car in rain or fog. Star shells are effective in rain and are not affected by the cordite or funnel smoke of their own ships. They can also illuminate at long range, and afford no aiming or ranging mark of use to the enemy.

On the other hand, the enemy is not illuminated instantaneously, that is, there is a pause during the time of flight till the shell bursts; they are not good if clouds are low; and, in small ships, the gun which fires them might otherwise be firing at the enemy. In practice therefore, it is usual to try to reap the advantages of both, that is, to begin firing with searchlights so as to obtain the *instantaneous* production of maximum output, firing star shells at the same time, and, when the star shells are seen to be effective, switching off the searchlights, which can always be resorted to again if needed.

One of the principal differences between land and sea anti-aircraft gunnery is that, at sea, the ship herself is the target, and the time available to a ship to bring down an aircraft approaching her directly is exceedingly short. For example, an aircraft with a speed of only 200 miles per hour, engaged at seven miles, will be under fire for only one minute before reaching her "bomb-release" position.

Air attacks on ships may be high level, low level, or dive bombing, or torpedo attack, and each presents its particular gunnery problem. For long-range A.A. fire, ships are fitted with a powerful armament of medium-calibre guns, capable of rapid training and elevating and a high rate of fire and a high muzzle velocity. They fire time-fuzed high explosive shells, and are fired by director. As in the case of night gunnery, an all-important factor is early sighting, and the same care is taken to provide air look-outs with efficient instruments and to train them where and how to look for aircraft.

Once aircraft are sighted and identified as hostile, not an instant can be lost in opening fire. Such is the speed of aircraft that it is necessary in some conditions to aim at a point approximately two miles ahead, so that at the end of the time of flight the aircraft and the shell will reach the same spot. The shell must be burst there by a time fuze whose setting must have been forecast not only for the distance the shell will have to travel, but also for the appreciable time that it takes to calculate it, pass the order to the guns, set the fuze, load the gun and fire.

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When fire is opened it is impossible to see whether bursts are over or short, and guns must continue to "fire to instrument." A continued stream of up-to-date data must therefore reach them, and a heavy fire be maintained during the very short interval between opening fire and the aircraft reaching the position of bomb release. It can be readily appreciated that all this means not only a high speed but clockwork precision.

Aircraft which press on through long-range A.A. fire to deliver low level or dive bombing or torpedo attack must come within the range of the close-range A.A. armament, that is, multiple pom-poms, which are eight 2-pounder guns mounted on a single mounting and firing shell fuzed to burst on impact. These guns are fired by director; multiple and other machine guns are also carried. These small weapons, ably handled, have taken a heavy toll of enemy airmen who have pressed home their attacks. They are fitted with a simple sight, and fire tracer ammunition, so that the layer can correct the fire by altering the point of aim.

The responsibility of selecting targets and of distributing the fire of the A.A. armament rests with the air defence officer, who is also responsible for the training and organization of the air look-outs. He has an assistant in case there are targets on both sides simultaneously; but, apart from this, the various A.A. control officers and captains of guns must be prepared to act on their own initiative since, once an attack starts, the situation develops too quickly for any one man to maintain complete control.

INCREASED A.A. ARMAMENT

In later ships, where anti-destroyer and A.A. armaments are combined in the secondary armament of the ship, this increases greatly, over a purely additional A.A. armament, the weight of metal which can be brought to bear on aircraft. This principle is also followed in later destroyers, which also carry multiple machine guns; and destroyers stationed as a screen in exactly the place where aircraft would like to drop their torpedoes are a very valuable defence for heavy ships.

The controversy "ships versus aircraft" still goes on. Before the Second World War, many people sincerely believed that warships, although indispensable in the open sea and on the ocean routes, would not be able to operate within two or three hundred miles of a hostile coast or in a closed sea such as the Mediterranean at all. Nevertheless, in the North Sea, off the coast of Norway and the Continent, in the Skagerrak, and frequently in the Mediterranean, our ships and the convoys they protect have faced powerful air attacks without the success that the German airman expects (and, incidentally, reports).

Casualties must be expected, especially as was the case off Crete, where support from our own aircraft was not available. The A.A. section of the gunnery branch only claims to be a worthy member of a team. It guarantees that such enemy aircraft as survive the bombing of their bases, and evade our intercepting fighter aircraft, will get an especially warm welcome from what is sometimes called the "aircraft reception committee."

So must end an attempt to condense naval gunnery into a single chapter. The work goes on. No one need be afraid that the gunnery material of the fleet will not be kept up to date, or that the gunnery training of the personnel will be allowed to grow slack or stand still.

On the dining-table in the ward-room at Whale Island, a delightful silver statuette of Saint Barbara, the patron saint of Artillerists, smiles down on successive generations of gunnery officers, who will not let her, or the Navy, down. Their job is to get straddles with full-gun salvoes of a reasonable spread; Saint Barbara herself arranges the hits.

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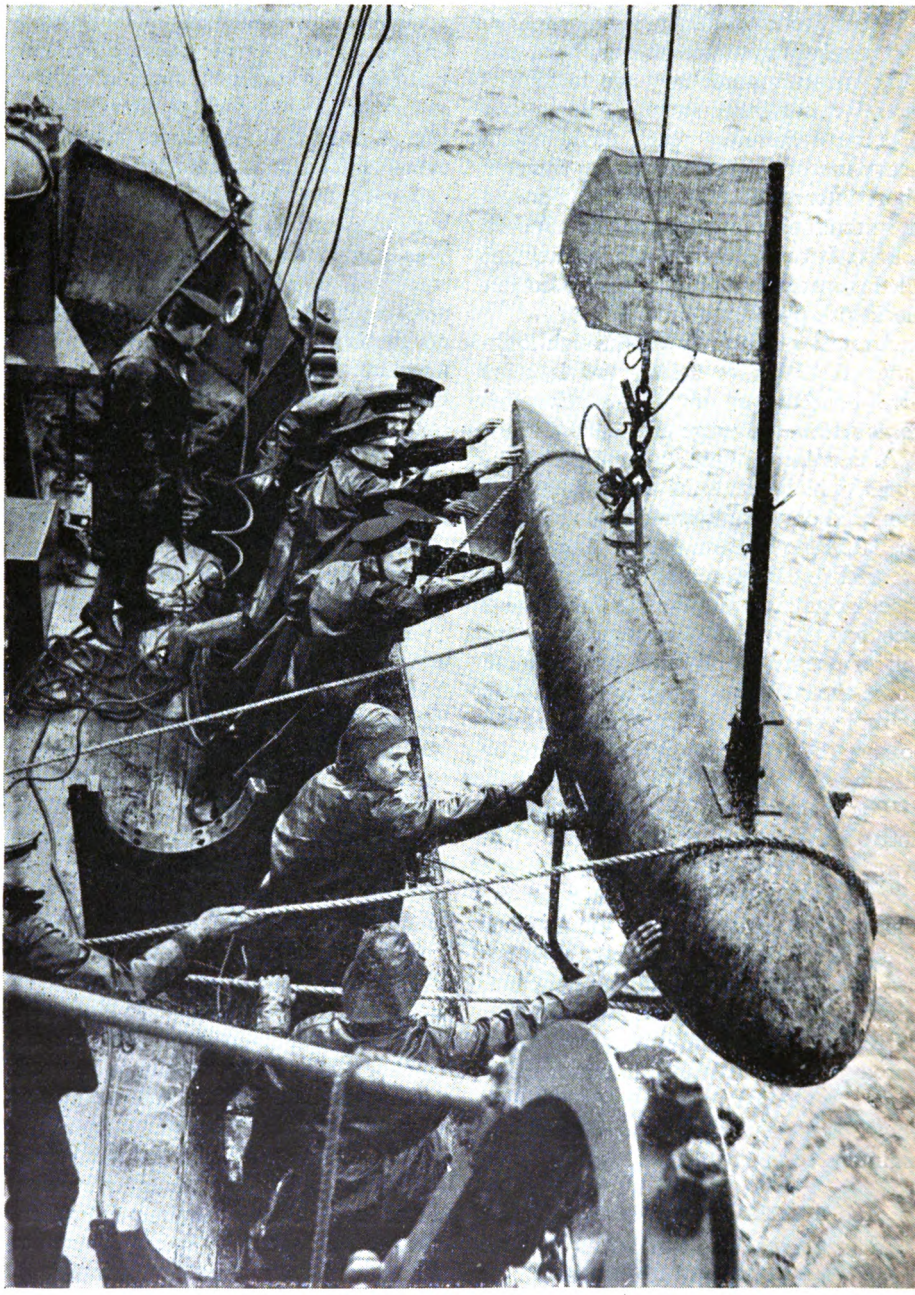

DROPPING AN OROPESA FLOAT (OR SWEEP) OVERBOARD

When a minesweeper is working alone, an Oropesa sweep is used, with a device known as an otter (or kite). The cutting wire is thus kept on the ship's quarter (*pages 233 and 234*)

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Section 3. OPERATIONS

CHAPTER 12

Mines and Mine Sweeping

The contact mine. Mooring method. Paravane device. Magnetic and acoustic principles. The drifting mine. Harbour defence mine. Design of minelayers. Aircraft as minelayers. Technique of a minefield. Types of sweepers. Oropesa sweep in operation. Perforating a mine. De-gaussing

THE mine is a weapon used to the limit of its effectiveness by both ourselves and the enemy. Mining and counter-mining constitute a ceaseless, almost invisible, war of their own; a war of thrust and parry, in which science, ingenuity, and stark cold-blooded courage are as much weapons as the mine itself. We will consider first of all mining as a measure used by us against the enemy.

The mine as a weapon differs fundamentally from other weapons used in naval warfare, such as the gun and the torpedo, in two main respects. In the first place fully realistic rehearsals are not practicable in peace time; you cannot lay a minefield and then steam your fleet through it to see whether the ships get blown up or not. Again, the gun, the torpedo, the depth charge and the bomb are directed against some individual ship, and their effect is achieved immediately. The individual mine, on the other hand, is not aimed at a particular target but forms part of a minefield which remains a potential danger indefinitely.

The laying of a minefield must therefore, as a general rule, be adapted to a long-term policy whose effectiveness can only be measured over a considerable period of time. In peace time, although the mechanism of mines can be developed and improved, and the mine can be technically tested under a limited variety of conditions, its full potentialities remain a matter for theoretical study, until war brings it into actual operation.

Mines may be classified under two broad headings: *Contact* and *Non-contact*.

The contact mine, as its name implies, requires to be struck by a ship in order to detonate. It is a buoyant metal sphere containing a charge of very high explosive. Projecting from it are a number of horns composed of soft metal which, on being bent or broken by impact, complete an electric circuit to the detonator and the charge explodes. It is moored to a sinker by a wire whose length is adjusted so that the mine floats at a predetermined depth beneath the surface. It is the simplest form of mine, and although improvements in detail are continually being made the principle is very much the same as when it was first introduced many years ago.

MAXIMUM DESTRUCTIVENESS

It has further advantages of simplicity and cheapness. Moreover, the explosion takes place directly in contact with the hull of the ship, thus ensuring maximum destructiveness. As an offset to these considerations it is comparatively easy to sweep up, and a device, known as a paravane, gives a certain measure of protection against it in mined waters.

The non-contact mine does not require to be struck by a ship in order to detonate.

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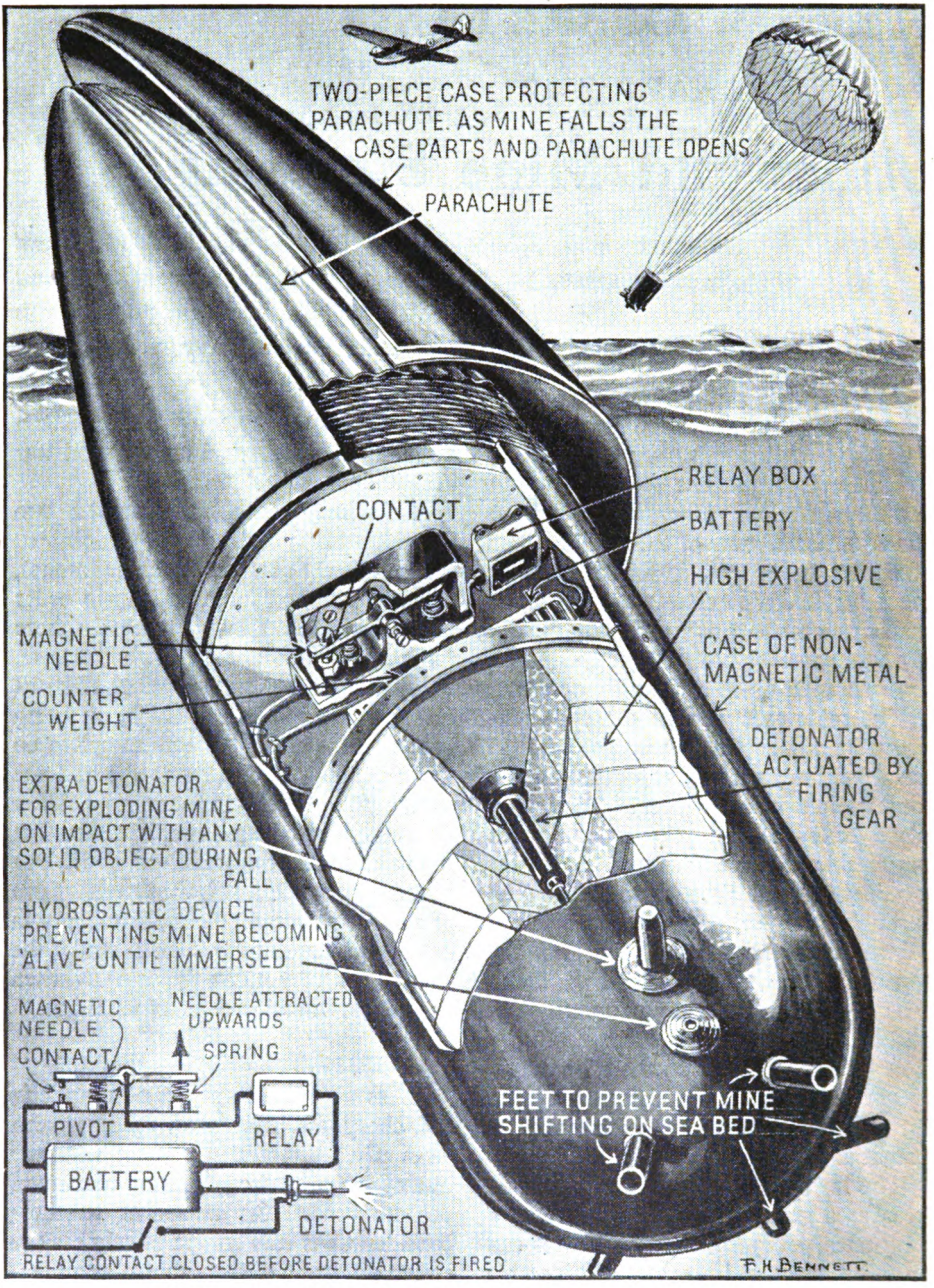

DIAGRAMMATIC DRAWING OF A MAGNETIC MINE

These mines are dropped by parachutes from aeroplanes. A ship is charged with a certain amount of magnetism. When it goes to sea it is, in effect, a sort of floating magnet. This attracts the needle which touches off the detonator in the mine, which is immediately detonated

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The most common types are the magnetic and the acoustic, the principles of which had already been used by us towards the end of the war of 1914-18.

While it is in process of being built a ship becomes charged with a certain amount of magnetism. When it goes to sea it is, in effect, a sort of floating magnet. When a magnet is held over a needle the needle jumps up and fastens itself on to the magnet; much the same sort of thing happens when a ship passes over a magnetic mine. It attracts a needle in the mine which touches off the detonator, and the mine explodes. That is, roughly, the principle of a magnetic mine.

The acoustic mine is touched off by sound. When a certain note is struck on a piano it may happen that some ornament in the room, such as an empty vase, vibrates to the note. That is because sound travels through the air in waves that strike the vase and cause it to ring. Sound travels through the water in much the same way, and vibrates a sensitive mechanism in the mine which detonates it when a ship's propeller is thudding away over its head.

ADVANTAGES AND DISADVANTAGES

The main advantages claimed for non-contact mines are:

(*a*) Special measures are required to deal with them, both as regards the apparatus of sweeping and the fitting of protective devices to ships.

(*b*) The explosion may take place under the ship's bottom, which is her most vulnerable part.

(*c*) A ship has less chance of getting through a minefield composed of non-contact mines than if they were contact mines.

Against these considerations, magnetic and acoustic mines have to be laid on the bottom of the sea. If moored in the same way as contact mines they are liable to be exploded by other influences than enemy ships, such as movements set up by the tide. They also require much larger explosive charges than the contact mine, because their explosion takes place some distance away from the hull of the ship which detonates them. Also, the non-contact mine has the disadvantage of being complicated and expensive, and its trickiness introduces certain difficulties to ensure that it is effective against ships of varying sizes and types.

DRIFTING MINES

In addition to the moored mine, anchored at a pre-determined depth below the surface, and the mine resting on the sea-bed, there is also the "drifting" mine. Apart from the fact that the use of such a mine is limited by international law, it can have only a restricted application. No nation, however unprincipled, is disposed to make widespread use of a weapon that is the sport of wind and tide, unless it is prepared to withdraw its own ships from active service altogether (a most unlikely proceeding) or to expose them to an unwarrantable risk.

Finally, there is the harbour-defence mine, which can be either fired from the shore or made safe or dangerous at will. The advantage of this type of mine lies in the fact that friendly ships can be ensured a safe passage through a minefield; but this is achieved at the expense of complication, both in laying and in the attendant apparatus required. A further drawback to it is that it requires personnel to maintain the apparatus and to man the control station, whereas the ordinary mine can be left to itself to function, automatically, at the right moment.

Practically any type of craft can be adapted to lay mines, but we must remember that the enemy ship is sunk by the *mine*, and not by the mine *layer*. It has to be borne in mind that minelayers are designed for the peculiar function of minelaying, as opposed to altering the

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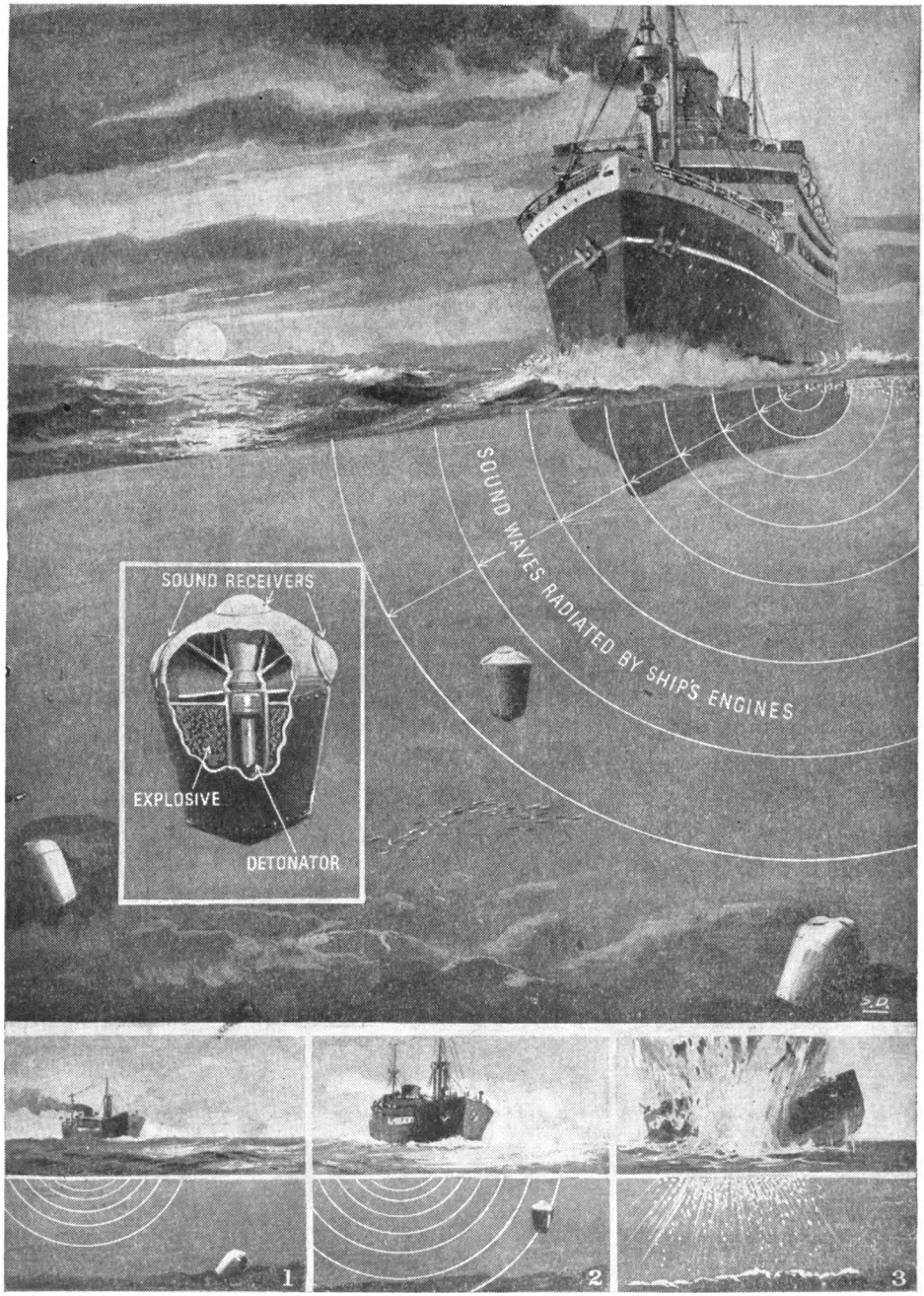

ANOTHER TYPE OF NON-CONTACT MINE—THE ACOUSTIC MINE

The acoustic mine is detonated by sound. The propellers of a ship (1) set up a sound vibration in the water. This is picked up (2) by the acoustic mine, which is then (3) detonated

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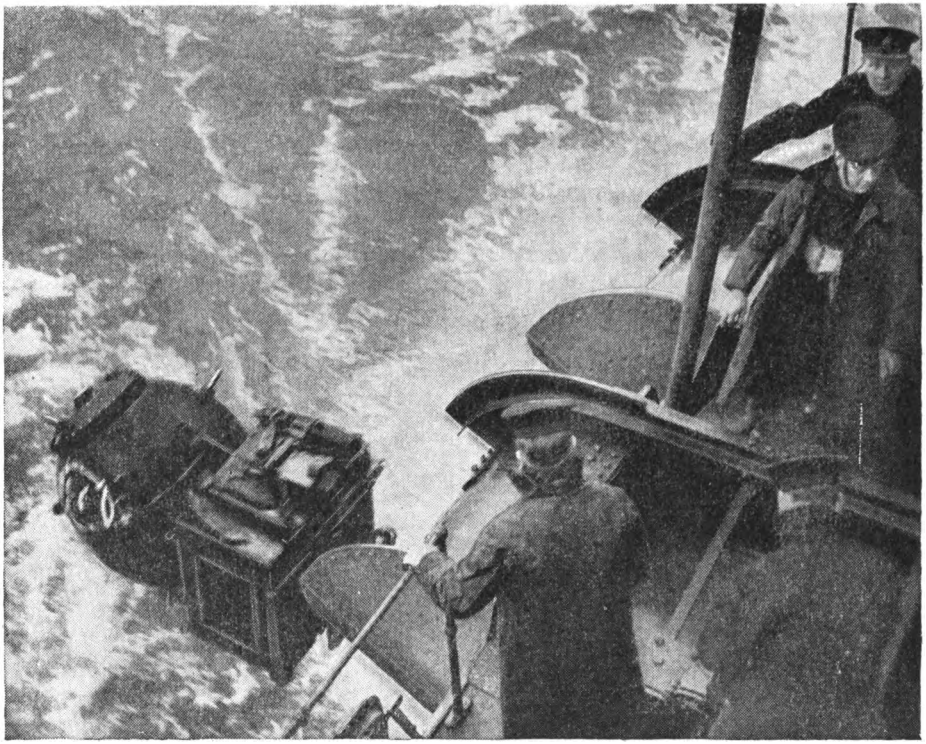

DROPPING A CONTACT MINE OVERBOARD

Contact mines are moored at a fixed depth. Attached to this mine can be seen the heavy weight which rests on the sea bed. The mooring wire is paid out from this until the mine arrives at its pre-arranged depth. It is this mooring wire which minesweepers cut with sweep wires

mines to fit in to some particular ship. The facility with which most ships can be converted into minelayers, combined with the fact that a vessel designed and built as a minelayer is of little practical use for any other purpose, means that in peace time there is a natural reluctance to invest much of the Navy Vote in the construction of this class of ship.

Broadly speaking, minelayers working in enemy waters rely for their protection on their ability to evade detection. In surface ships therefore the requirements are high speed and a small silhouette, and mine-carrying capacity must be sacrificed to meet these requirements.

Submarine minelayers can evade detection by submerging; but the number of mines they carry is limited, and the waters in which they can operate are to some extent restricted.

For laying in waters where direct protection can be given by aerial or surface escorts two main types of minelayer are required:

(*a*) Ships with good sea-keeping qualities, capable of carrying sufficient mines for laying extensive barrages.

(*b*) Small handy ships carrying a smaller number of mines for laying inshore minefields or reinforcing larger fields.

In neither of these classes of ships is high speed a requirement.

The employment of aircraft for minelaying is a new feature in war. Aircraft are peculiarly well adapted to the laying of

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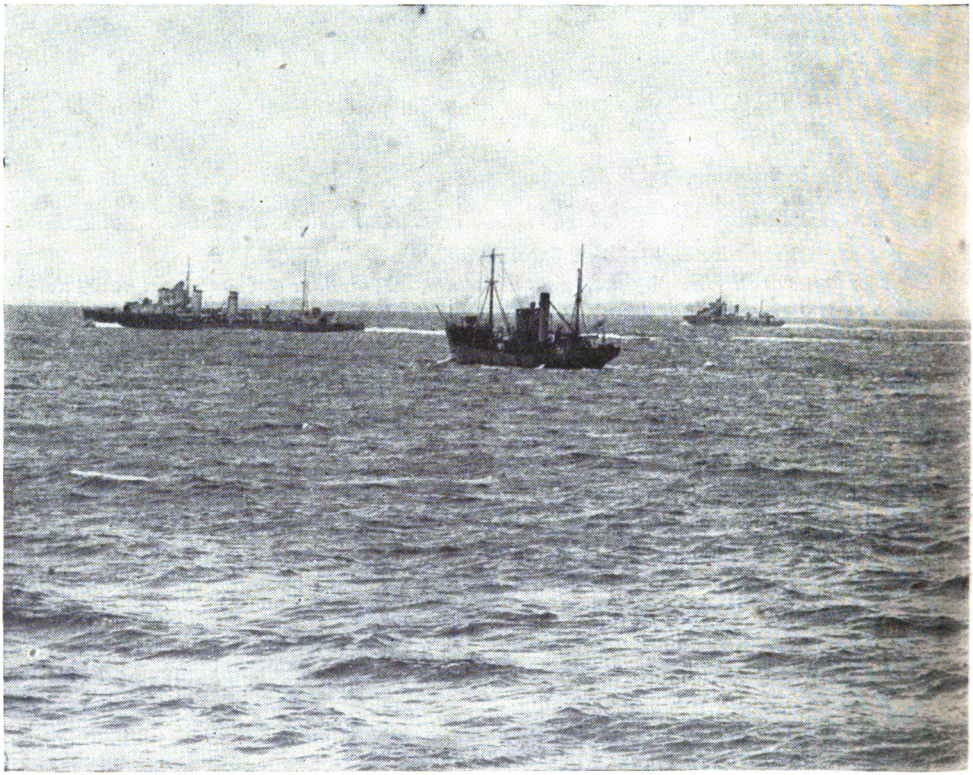
non-contact mines, not only because this type lends itself to production in a form that can be carried in an aeroplane but because the latter can operate over harbours and estuaries inside patrol cordons, waters that would be inaccessible to surface craft or submarines.

The aircraft has an outstanding advantage in being able to add to or replenish an existing minefield without danger to itself. The aircraft, however, can only carry a small number of mines and the difficulty of placing them accurately at night in unlit waters calls for very highly skilled navigating.

A popular misconception of a minefield is that its presence forbids a passage to enemy ships. Quite apart from such considerations as the rise and fall of the tide and the breaking away of mines in heavy weather, it is normally impossible to mine an area so thickly that a ship will not have some chance, even though a remote chance, of getting through. This is due to the fact that mines must be laid a certain distance apart, in order to prevent the explosion of one mine either causing the adjacent mines to explode or so damaging their internal mechanism that they become inoperative.

As was suggested at the beginning of this chapter the mine, or rather the minefield, is a long-term weapon. The whole problem of minelaying is really one of



A FLOTILLA OF BRITISH TRAWLER

To keep the trade routes of Britain safe is one of the main tasks of the Royal Navy. By means of the mine, the torpedo and the aerial bomb the enemy strives to close these routes. Sweeping up enemy mines is a dangerous task, much of which is done by trawlers manned by

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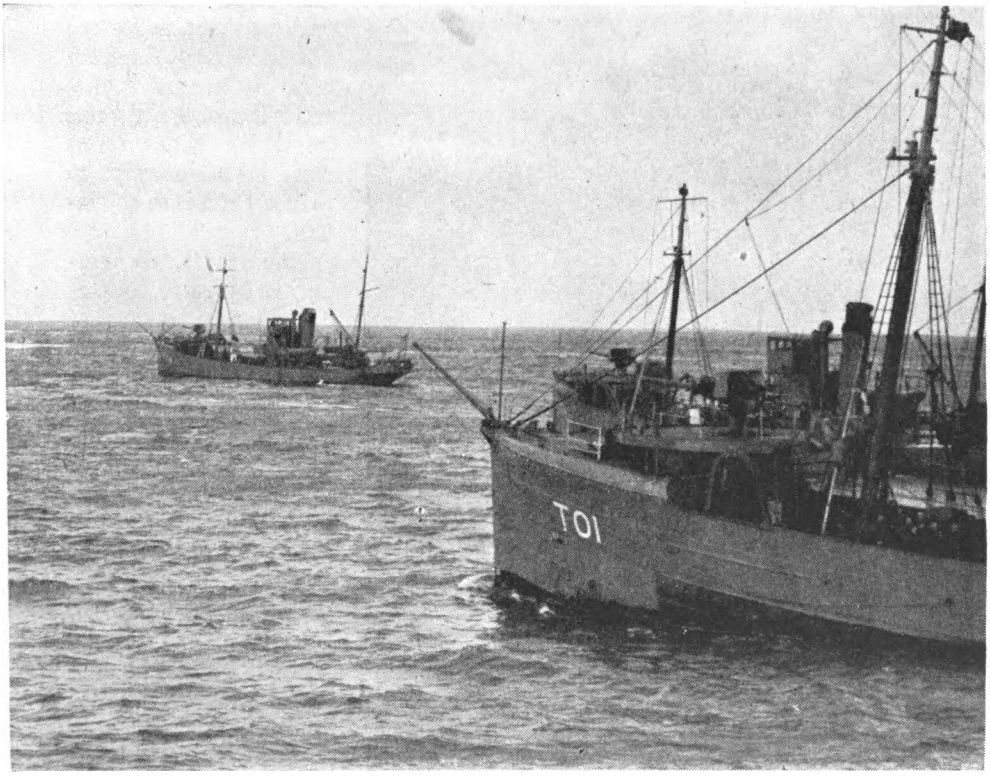
strategy rather than of tactics. Within this broad framework minefields may be classified under two headings:

(*a*) The small field laid in enemy waters with the object of destroying any vessel that happens to pass through the area. The indirect result of such a field, or even its suspected existence, compels the enemy to employ sweepers and men in numbers greatly disproportionate to those required to lay the mines.

(*b*) The large barrage, laid with the object of protecting some vital area, or of compelling the enemy to follow some course of action that enables him to be dealt with by other means.

Mines, once they are laid, are a danger to both sides. Thus, when laying in enemy waters care must be taken that future operations are not likely to be prejudiced; and when protective fields are laid, careful planning is essential to ensure that too great an area is not fouled in the first instance. This is necessary to ensure the safety of our minelayers, which must only approach within a certain distance of mines that have been previously laid. If too great an area is fouled at the start, it not only means that the movements of our own ships may be unnecessarily restricted but that insufficient room may be left for adding to the same minefield if this should be required at a later date.



MINESWEEPERS KEEPING THE SEA LANES CLEAR

fishermen. Here, with two destroyers on patrol in the background, trawlers are seen at work. Such minesweepers usually work in pairs or in flotillas. In the latter case, the ships are disposed in echelon, and each one steers on the flag of the Oropesa float of the ship ahead

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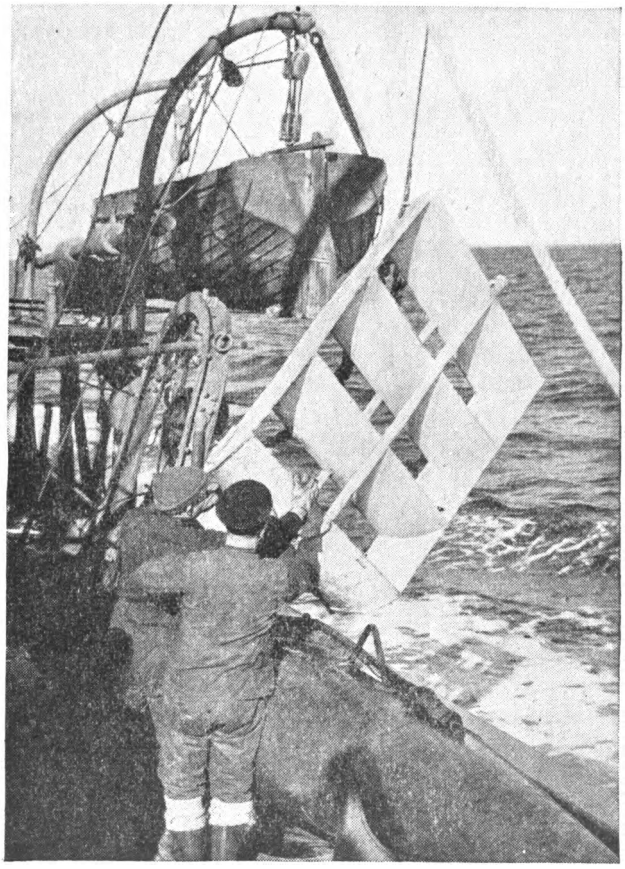
Minelaying is not an end in itself but a means to an end—the control of sea communications. The effectiveness of a minefield cannot be judged merely by the number of casualties that it causes, but rather by the extent to which it achieves the particular object in view. The development of an extensive minelaying campaign entails intricate problems of supply, transport and storage; minefields do not spring into being with the facility that a coloured area can be drawn on a chart.

The business of minelaying places a considerable strain on the officers and men engaged in it. The essential point of their work, particularly in enemy waters, is that it must be conducted in silence and secrecy. It is unspectacular to a degree, wherever carried out, and to go about the business without the satisfaction of seeing results, and continually living with a cargo of high explosives, calls for a considerable measure of courage and endurance.

We have discussed the mine as a weapon of offence and protection in our hands, and will now consider it as a weapon used by the enemy against us.

The three weapons directed against our sea lines of communication—the torpedo, mine and aerial bomb—are Germany's attempt to find a substitute for sea power. Of these three the mine is the most subtle, and it is probably the one on which Hitler relied most in his attempt to reduce Britain to starvation.



THE KITE (OR OTTER) GOES OVERBOARD

The kite is a steel frame in which planes are set. The rush of water past these carries the wire away from the towing ship. Instead of stretching astern, the wire thus forms a big curve

The measures employed by us to counter this menace cannot of course be described in detail in wartime, but something can be said of the methods employed to sweep for contact or moored mines.

Broadly speaking there are three types of minesweepers:

(*a*) Fleet Sweepers. These are specially built vessels, of shallow draught, but capable of sweeping in all weathers in the open sea.

(*b*) Paddle Minesweepers. This class of small vessel was

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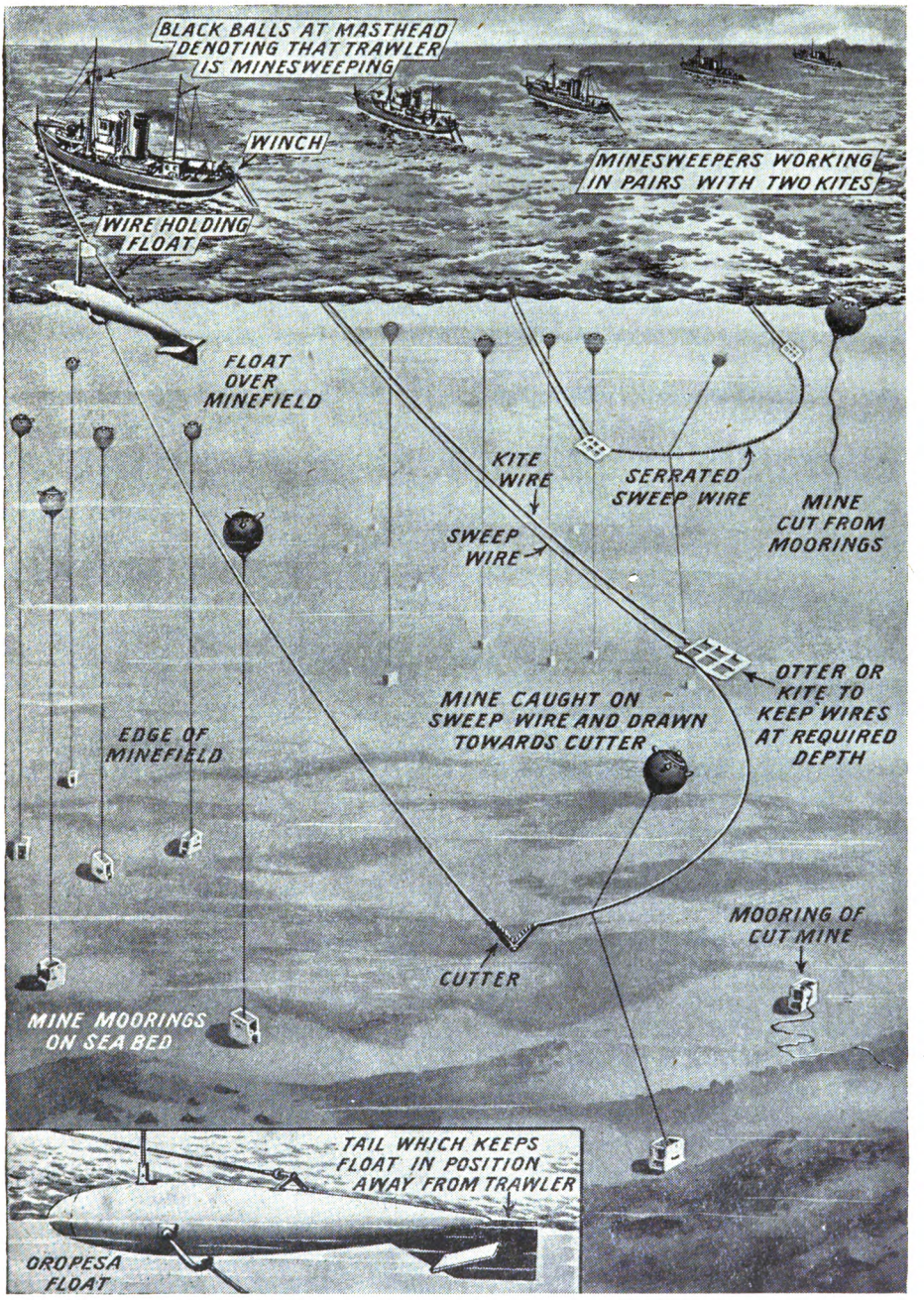
BLACK BALLS AT MASTHEAD DENOTING THAT TRAWLER IS MINESWEEPING
WINCH
MINESWEEPERS WORKING IN PAIRS WITH TWO KITES
WIRE HOLDING FLOAT
FLOAT OVER MINEFIELD
KITE WIRE
SERRATED SWEEP WIRE
MINE CUT FROM MOORINGS
SWEEP WIRE
OTTER OR KITE TO KEEP WIRES AT REQUIRED DEPTH
MINE CAUGHT ON SWEEP WIRE AND DRAWN TOWARDS CUTTER
EDGE OF MINEFIELD
MOORING OF CUT MINE
CUTTER
MINE MOORINGS ON SEA BED
TAIL WHICH KEEPS FLOAT IN POSITION AWAY FROM TRAWLER
OROPESA FLOAT

HOW A MINEFIELD IS CLEARED BY MINESWEEPERS

The minesweeper on the left is working alone; those on the right are working in pairs and using two kites. Inset is shown the Oropesa float which keeps the wire away from the trawlers

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employed in peace time in the tourist traffic on coastwise or harbour routes. They were well adapted for sweeping, on account of their shallow draught, and are not much use for any other purpose as they do not stand up to heavy weather outside coastal waters.

(*c*) Trawlers and other small sturdy shallow-draught craft. All are armed against attack by aircraft.

The Oropesa sweep is a buoyant cigar-shaped steel cylinder towed by a wire several hundred feet long. It has a short mast and flag on its nose which enables it to be seen on the surface. This is towed by the sweeper and would normally travel directly astern; but a device called an otter, which is a square steel frame, is suspended from the wire. Within the frame, vertical planes are set at an angle like the slats of a venetian blind; the rush of water past these slats carries it out, and with it the Oropesa float, on to the quarter of the towing ship. Instead of stretching directly astern, therefore, the wire is curved in the form of a gigantic sickle. A contraption similar to the otter, only with the planes set horizontally, is secured to the end of the wire nearest the sweeper and this has the effect of keeping the wire at any desired depth.

CUTTING THE MOORINGS

Earlier in this chapter we described the contact mine. The method of mooring it is common to both sides. The curved sweep of the towing wire encounters the mooring wire and cuts it. The mine, which is buoyant, bobs up to the surface.

Sweepers usually work in pairs or in flotillas, ships disposed in echelon—which means that each ship steers on the Oropesa flag of the ship ahead of her. Known minefields are cleared by a flotilla working along the edge of the field in a succession of sweeps, something on the principle of a bacon-slicing machine. As a mine bobs to the surface the ship astern is warned by a succession of blasts on the siren. The sweepers are followed by a craft whose duty it is to perforate the mines by rifle or machine-gun fire. When sufficient holes have been punched in the steel case of the mine it becomes waterlogged and sinks to the bottom out of harm's way.

EYE-WITNESS STORY

An eye-witness of one of these mine clearance operations has described it:

"There had been a three days' gale, and steep tumbling seas, the colour of greenish pea soup, were breaking in patches over the hidden sandbanks. From time to time we passed a buoy marking the tail of a shoal, on which a bell clanged mournfully as it rose and dipped in the sluicing tide. Presently we came to the area where mines were suspected; the order was given to start sweeping, and overboard went the Oropesa.

"Squalls of sleet swept down out of the purple-black clouds to windward as we plunged along the edge of the suspected area. About every half-hour we turned and carved off another slice, cutting deeper into the minefield each time. Whenever a mine bobbed up in the sweep we gave a few blasts on the siren to warn our next astern. Each time, the third ship drew out of the line and sank the mine with short staccato bursts of machine-gun fire. It was all perfectly co-ordinated, almost mechanically efficient.

"As the day advanced the sun appeared through rifts in the clouds, throwing fan-shaped beams of light on the water. The anti-aircraft gunners slipped dark goggles over their eyes in case of a dive bomber coming out of the glare. Suddenly there was a warning shout from a look-out, and two Messerschmitts appeared on the edge of a cloud out of range. They circled like hawks, disappearing and re-appearing in the dark cloud valleys.

"Then one banked for the dive and our guns broke out in a furious cannonade,

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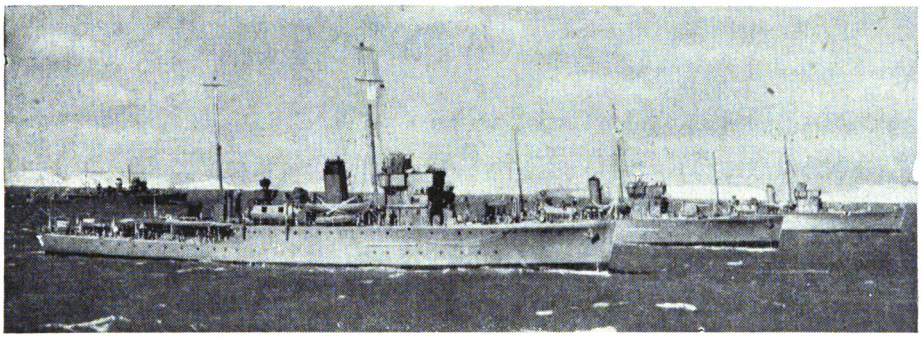
throwing a barrage of bursting shells in the path of the attack. A tiny thing the size of a pea was falling towards us; another followed. The thin whistle of their falling changed to a shriek; the pom-poms, holding their fire, burst into a deafening racket. A bomb burst ahead of us and a moment later one astern, throwing columns of water into the air. The bomber had turned away in the teeth of the barrage and was already lost to sight. It was just an incident in a day's mine sweeping, and the incident was closed."

In discussing the principle of the magnetic mine we observed that ships had been reported. The sweeper I was on board was a new ship and making her maiden trip. Whenever a sweeper blows up a mine she paints a chevron—a mark like a lance-corporal's stripe—on her funnel. One sweeper had as many as sixty: we had none; consequently there was a good deal of excitement on board as to how soon we should touch off our first mine. Suddenly the sweeper lifted as if a giant had kicked her. The sea nearby changed into a mountain of water, white on the summit and black at the base, flecked with lambent flame. Not merely one's heart but the whole structure



FLEET MINESWEEPERS AT WORK

Fleet minesweepers are ships specially built for their job. Paddle and trawler minesweepers are converted vessels. The fleet sweepers are of shallow draught and can operate in any weather

become charged with magnetism while in process of being built. This is partly due to lying in the field of the earth's magnetism and partly to the vibration caused by riveting. By a process known as "de-gaussing" it is possible to neutralize this ship magnetism. A Doctor Gauss in the first half of the nineteenth century gave his name to the unit of magnetic flux, which has been adopted to describe the process. The ship ceases to be a magnet; which is an antidote as far as the ship herself is concerned, but it does not affect the mine. We quote again:

"Before it was light a flotilla of sweepers had cast off from their moorings and were heading towards the fairway where mines

of the body contracted and relaxed again. There was a roar that filled all space. The sweeper shuddered like a living thing reprieved from death: as we all were, because the mountain of water collapsed harmlessly. A dead gull came eddying down like a falling leaf."

The crews of minesweepers used to be nearly all fishermen, but nowadays they come from all walks of life. Some have considerable attainments as physicists and some have hardly any qualifications for the job, except handiness and courage. It is thanks to these men that the convoys come and go with food, and tobacco, and tea, and munitions, enabling Britain not only to live but to live in comfort.

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GUARDING A BRITISH SUPPLY CONVOY

British convoys are closely guarded. A Coastal Command aircraft is here cruising overhead while the men on the corvette set the fuzes of the depth charges in readiness for action

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CHAPTER 13

General Sea Strategy

The influence of the Navy on all past wars. Value of air support and shore bases. Command of the sea and its limitations. Invasion and raids. The Battle of the Atlantic. The Mediterranean. Convoys, their advantages and disadvantages. Number of escort required. Submarine and air attack. Fast motor boats. Use of capital ships with convoys

In any war in which we, as a maritime nation, may be involved the Navy exercises a decisive influence on the conduct and issue of the conflict. Superiority at sea may largely affect the issue of a war even though no major naval engagements take place.

When writing of the war of 1914-18, the late Lord Oxford and Asquith said: "It was the British Navy which fed and equipped the Allies; by successive stages drained the life-blood of the enemy and won the war." This cannot be denied. It is not, of course, suggested that the land and air forces could have contributed more than they did to victory; they did their full share. Our land and air forces are absolutely necessary, and on them our naval strategy largely depends.

Without assistance from our land and air forces our naval bases could not be defended, and a navy would indeed be a broken reed if denied assistance from the modern weapons of the air. There is little doubt that, without Britain's sea power, the life-line of France would have been cut during the first two years of the war of 1914-18. Again, let us reflect on our tanks-for-Russia production; without British sea power, Russia could not receive even one of those tanks.

The main aim of our naval strategy is command of the sea. The existence of these islands and, in fact, of every portion of the British Empire depends on the power of the fleets to retain command of the sea against every form of attack. It is well to note that the expression "command of the sea" has no definite meaning except in time of war. In peace time each nation controls its own territorial waters. It has long been recognized that a nation possesses territorial rights over a strip of sea round her coasts, and when the range of guns was a mere league the distance of three nautical miles was generally accepted as the limit of territorial waters.

INLAND SEAS

National control was also extended to cover deep bays, not more than ten miles across from shore to shore, and expanses of inland sea. Claims have, from time to time, been made to extend this distance to beyond three miles from the shore, but such claims have never been universally admitted. Outside the limit of territorial waters lies the High Sea, and the dividing line between the two is definite in civil as well as in international law. There is no law to prohibit the passage of belligerent warships through neutral waters, but neutral States should prohibit such passage unless the waters concerned form part of a recognized highway for international traffic.

"Command of the sea" refers, therefore, only to the high seas, and it is

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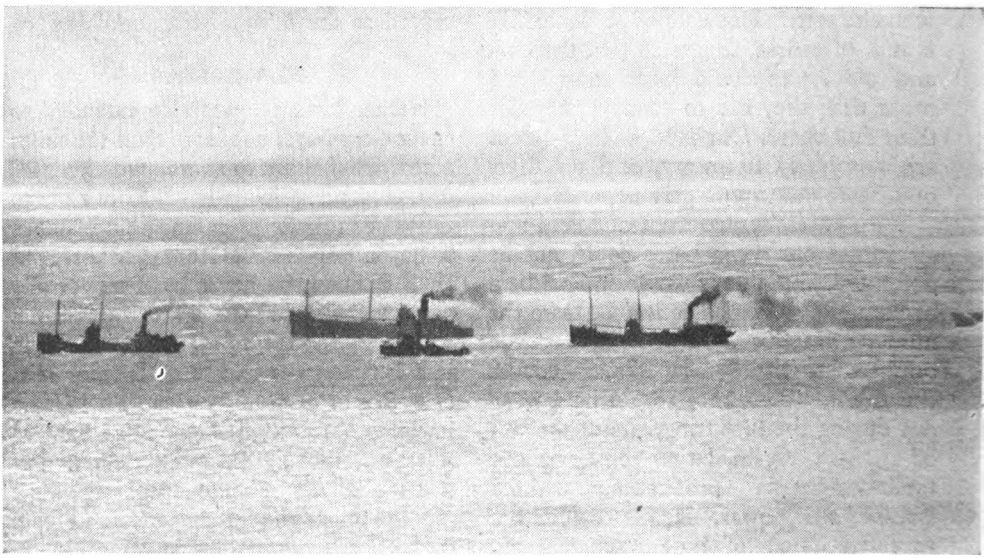
because of this that the term has no meaning except in war. In peace time the high sea is the property of all and no nation can claim possession or control over it in any way. But in time of war each belligerent strives to secure the command of the sea for himself, and by doing so he can deny its use to his enemy. Broadly speaking command of the sea is the ability to close the highways of the ocean to enemy ships, while one's own ships can traverse them in safety.

The phrase "command of the sea" is therefore somewhat loose and misleading, because it is well-nigh impossible for any nation, however great its maritime strength, to claim control over every part of the high seas at one and the same time. Actual command of the sea is necessarily very local and usually temporary. It may well be absolute in certain areas at certain times, but can never be absolute in all areas at all times.

During the war of 1914-18 it can, broadly speaking, be said that Great Britain obtained command of the sea. At the outbreak of the war Germany had several armed ships overseas, but these were all accounted for in the first few months, and by the end of 1914 it could justly be claimed that, with the exception of an occasional armed raider and submarines, Germany's Navy had been swept from the Seven Seas. Within forty-eight hours of war being declared, 724 enemy merchant vessels took refuge in neutral ports and remained therein for four years for fear of capture.

It is a matter for pride that no British merchant ship sought such shelter, and those who have read the accounts of the exploits of our Merchant Navy and fishing fleets will realize that our merchant seamen are still endowed with the sea sense and sea courage which has been theirs throughout the centuries.

Let us reflect for a space as to why command of the sea is, in some measure, absolutely necessary not only to the successful prosecution of the war but to our



A BRITISH CONVOY, UNDER COVER OF A

Convoys of supplies must at whatever cost be brought home to Britain. The ships are subjected to attack from the air, the sea and, on occasion, the land. This convoy, sailing up the English

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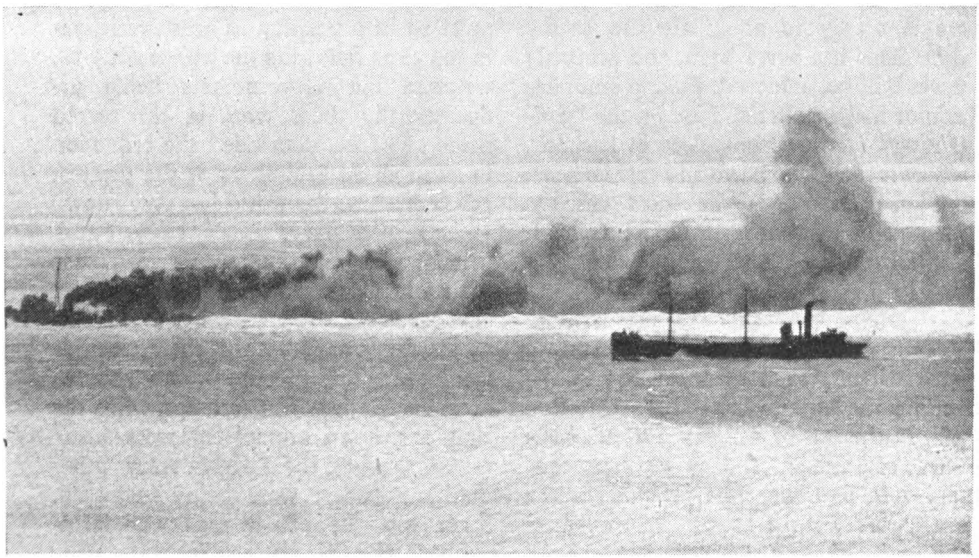
very existence as an Empire. In these islands we are dependent on sea-borne supplies for the major portion of the food we eat; for the raw materials which keep our factories going and produce armaments; for the liquid fuel essential to transport by sea, land and air, If we lost control at sea we would starve; our troops and their supplies could not be transported overseas, and our incomparable air force would be rendered impotent for lack of fuel. Our merchant ships *must* be kept always on the move.

No Navy, no Army, no Air Force, no Civil Defence Service could give us security if our Merchant Navy ceased to function. The people of Great Britain have shown that they can stand up to the horrors of bombardment from the air, but even the toughest and bravest of us would have to bow to the terrors of starvation. What of the Empire overseas? The help, so freely and patriotically given, would be impossible if sea transport was denied us; and the surplus commodities produced in the Dominions and Colonies would run to waste, with a corresponding loss of trade.

The British Empire can be likened to the human body. England, the heart; the Dominions overseas, the limbs. The heart is of little use without the limbs, and the limbs are useless without a heart; but to kill a man it is not necessary to sever the limbs or to pierce the heart. Death can be caused by severing the vital arteries which join the limbs to the heart; and death to our Empire would result if the highways of the ocean—the vital arteries—were under enemy control.

In other words, the defence of Britain does not lie in the defence of the British Isles alone. Herein lies the aim of naval strategy—to protect the highways of the ocean so that our merchant ships can keep always on the move in comparative safety. This can be achieved only by obtaining command of the sea, and command of the sea cannot be attained without completely adequate naval strength.



SMOKE SCREEN, SAILS UP THE CHANNEL

Channel, has just been shelled by the German guns on the French coast. The escorting destroyers laid down a smoke screen and the convoy sailed calmly and safely on its way

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It follows, therefore, that the security of our Empire is dependent on sea power. Now, sea power does not depend solely on armed ships; its very foundation lies in the Merchant Navy. Power *over* the sea is not power *from* the sea. Power from the sea or sea power in its broadest sense, can be attained only by those nations which maintain an efficient mercantile marine in peace time, and protect it in wartime. A country which has no mercantile marine has not, and cannot have, sea power, or power derived from the sea. It was by sea power our Empire came into being and by sea power it prospered. With the increase of sea-borne commerce under the British Flag our naval strength also increased. Naval power and mercantile strength invariably rise or fall together.

It has been said that during the war of 1914-18 we had command of the sea to an extent which enabled us to keep our ships on the move. This nearly complete command was attained by sea power. The surest way of obtaining command of the sea is totally to annihilate the enemy fleet. This has never been, and probably never will be, achieved. Failing annihilation or major material damage, the "containing" of the enemy fleet in harbour, where it can do no harm and eats its heart out in idleness, is the most efficient method of preventing interference with sea-borne trade.

CONTAINED IN HARBOUR

That portion of the German surface navy which was not annihilated in the various naval actions during the first year of the war of 1914-18 was, after the Battle of Jutland, on May 31, 1916, contained in harbour. The problem of the submarine was, of course, another matter; and, although the menace could not be removed as in the case of surface raiders, it was dealt with and finally overcome by various anti-submarine measures. That war demonstrated, to all those not already aware of the fact, that to obtain command of the sea in sufficient measure to give reasonable security to our Empire we must have sea power. We must maintain a navy worthy of our world-wide responsibilities as the leading maritime nation. A navy can no more be improvised than can a garden; consequently if we wish to be strong enough to defend our shipping at the outbreak of a war, we must maintain a considerable navy in time of peace.

EXPENSE IN A HURRY

Writing, in 1879, to her Prime Minister, Queen Victoria said: "Never let your Army and Navy down so low as to have to go to great expense in a hurry." It is not only "great expense in a hurry" which should be avoided, but the jeopardizing of peace by allowing the armed forces to fall below that level which will give security. Without security there can be no peace—there may be defeat, but defeat is not peace. Those who desire peace must be in a position to preserve it; yet in the years following the war of 1914-18, we find our Governments being influenced by those who, in the sacred name of peace, demanded the reduction in strength and numbers of the greatest peace machine the world has ever known —the British Navy.

Many of the supporters of those societies, movements and unions who clamoured for a reduction in naval armaments, failed to realize that their demands would have no influence on any government except our own; and that, while the Empire's naval armaments were being reduced, those of nearly every other maritime nation were being increased. Such was the actual result of international disarmament conferences.

All strategy must, of course, mainly depend on the strength available to carry it out, and the strength of a navy depends

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not only on the number of its fighting ships, but on the security of its bases. In 1914, our Navy was lamentably short of cruisers and destroyers. The 124 cruisers then available was, however, far greater than the number available in 1939. In 1929 Lord Jellicoe stated that the minimum number of cruisers necessary to carry out merely the peace duties of the Navy was seventy; yet by 1935 this number had been reduced to thirty-six. Our Naval Air Arm was also woefully inadequate in strength.

Be our fleet ever so strong we cannot command the sea without a chain of secure bases distributed about the world, wherein our fighting and merchant ships can effect repairs and obtain supplies of fuel and stores. Bases are as necessary to ships as petrol stations are to long-distance motor coaches, or as aerodromes are to aircraft. Our forefathers realized the value of bases for our ships. They founded the bases, protected them and maintained them. We must not consider overseas bases merely as pieces of land, possessions which are coloured red on the map; rather must we consider them as a necessary adjunct to the fleet which is essential to the security of our far-flung Empire. Since the advent of the air weapon, bases are even more important.

GIBRALTAR, A "KEY"

A base does not command a position; it is the force which operates from the base which commands it. We are accustomed to hear Gibraltar referred to as "the key to the Mediterranean," because it commands the "Straits." Granted that Gibraltar is a "key"; but it does not entirely command the adjacent waters. It protects the ships therein and the supplies maintained there; but it is the fleet and the aircraft working from the base which command the nearby waters.

Naval strategy is, therefore, governed by the position and security of bases as well as by the strength of the fighting ships. It is also largely influenced by the assistance which can be effectively expected from the Royal Air Force.

The duties allotted to our Navy in time of war are threefold, and the successful performance of these depends on close co-operation with the Air Force and the assistance of the Merchant Navy. These duties are, generally speaking, as follows: To ensure adequate supplies of food and raw materials reaching Great Britain by sea; to ensure the safe transport overseas of our troops and supplies for our Army and air force; to prevent invasion by sea of every part of the Empire.

WATCHING UNCEASINGLY

To enable these tasks to be performed unceasing watchfulness is necessary. "What is the Navy doing?" is frequently asked by the ill-informed. What is the Navy doing? Watching. Always watching. Patrolling the coasts of our Empire, patrolling the trade routes, escorting merchant ships, clearing minefields and a thousand other occupations in arctic cold and tropic heat, in fog and darkness, in calms and storms, by night and by day: watching—unceasingly.

But, because "watching" is not exciting news, little is heard of the routine work of the Navy in the broadcast bulletins; if even a fraction of what the Navy is doing was introduced into the news bulletins, there would be no space for other news. We give little thought to the policeman on his beat at night; he is not occupied in arresting someone every time he turns a corner, but his presence gives us security, and if he makes a spectacular arrest he figures in the news.

In like manner we hear of our Navy when the opportunity for spectacular action arrives. By unceasing watchfulness the Navy seldom misses an opportunity of engaging and sinking enemy ships, or hunting them back into their harbours.

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STEAMING WITH A CONVOY OF

All types of ships sail in convoys, though it is usual to group together ships of similar speeds. This scene depicts a group of small colliers in the North Sea, steaming in line ahead and

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BRITISH COLLIERS IN THE NORTH SEA

keeping exact station. The speed of a convoy is that of the slowest ship and instructions for station-keeping are laid down by the officer in charge. Only on his orders does a convoy disperse

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"The Navy is here!" has been a cry welcomed by friends and feared by enemies on many occasions.

Before the advent of aircraft, invasion of these islands could take place only by sea. The Navy, and the Navy alone, was responsible for preventing this, and right well did it perform its task. "If only I could obtain command of that sea for twenty-four hours," said Napoleon, "I could invade and subdue England." But it was ships like H.M.S. *Victory*, and men like Nelson, that prevented him from obtaining that essential command.

INVASION AND RAID

When considering this matter we must differentiate between invasion and raid. If we take invasion to mean the landing of troops in sufficient number to defeat our land forces and occupy a considerable portion of the country, it is certain that such an invasion would depend mainly on the sea. The requirements of a modern army are much too numerous and weighty to permit their carriage by air alone.

A raid, or the landing of a comparatively small number of enemy troops, could, however, well be made by air and would almost certainly precede invasion. It is for the Royal Air Force to counter such a raid, and for the Navy, assisted by the Royal Air Force, to retain that control over the sea which would prevent the subsequent invasion.

That the Navy alone, including, of course, its own Naval Air Arm, can prevent invasion by sea-borne troops was clearly demonstrated at Crete. To enable the Army and Air Force to be evacuated, our ships were ordered to prevent any enemy troops or supplies reaching the island by sea. Without hesitation, and knowing no air support would be available, the job was undertaken. Despite bombardment from the air of greater intensity than ever before experienced by ships, the task was carried out; but not, however, without loss. Four cruisers and six destroyers was a heavy price to pay for maintaining the control at sea without which the 17,000 men evacuated by the Navy could never have been extricated.

Successful invasion of Great Britain on a large scale must still depend on the enemy obtaining control of the sea as well as of the air; and not merely temporary control, because if the enemy lost that control after landing was effected, his lines of communication could be cut.

The safeguarding of sea-borne supplies and the safe transport of troops overseas can be summed up in the phrase so often heard: "The Battle of the Atlantic." The Battle of the Atlantic does not refer to any specific major naval action which has taken place in that ocean. It is true that in the North Atlantic, especially in the eastern portion, Germany made her main effort against our shipping. Our shipping is, however, not immune from attack in any part of the world, and the Seven Seas must everywhere be protected.

The term "Battle of the Atlantic" can, therefore, be taken to refer to the contest waged between our Empire on the one hand, and the Axis Powers on the other hand, to determine whether our essential supplies can, or cannot, reach these islands. The Battle of the Atlantic is a vital issue in the fight for freedom and civilization. If our sea communications are not maintained, this battle is lost.

SUBMARINE MENACE

In the war of 1914-18, this same contest was being waged, but with less intensity. The menace to be met, after the first six months, was mainly that from submarines with the possibility of attack from aircraft in narrow waters adjacent to the enemy's coast. The problem of protecting our ships is now rendered many times more difficult. The problem in the Mediterranean is of far greater moment than during the previous war. The fac

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must be faced that, although no other nation controls those waters, our control has been partial only, thus necessitating much use being made of the longer, but safer, sea route by the Cape of Good Hope. As evidenced by the recent occasional passage of convoys through the Mediterranean, we have a certain degree of control of the sea.

ENEMY BASES

There is also a far greater handicap which now faces us. The occupation by Germany of the ports and aerodromes of Norway, Denmark, Holland, Belgium and France gives our enemies bases which are within a very short distance of our trade routes as they converge on these islands. The German submarine menace off our south-west coasts during the war of 1914-18 was met, with good effect, by hunting craft operating from our bases in Southern Ireland. Those important bases are now denied to our Navy and our aircraft. The denial of their use, by seriously hampering our naval strategy, gives direct assistance to the enemy. Considerable extra wear and tear of material and personnel is caused, and extra fuel is expended, on account of the extra 200 or 300 miles which have to be covered.

The problem of how best to protect merchant ships on the high seas is met by an efficient convoy system, and the defensive arming of merchant ships. This applies whether the menace is limited (as in the Napoleonic wars) to surface vessels, or (as it was in the war of 1914-18) to surface vessels and submarines, or to aircraft in addition to older weapons.

Convoying is not new. Convoys were known in ancient times, and were common throughout the seventeenth and eighteenth centuries. When war broke out in 1914, no arrangements were in force whereby the convoy system could be introduced at short notice; it had not been foreseen and could not have been foreseen that Germany would teach the world what could be done with submarines if all scruples were thrown aside. The law decrees that a warship of a belligerent power may stop and examine any merchant vessel on the high sea. If that ship is found to be carrying goods of use to the enemy, she may be seized for adjudication by the Prize Court.

Under certain circumstances the destruction of the ship is permissible, provided always that due provision is made for the safety of all on board. An open boat far from land is not due provision. When, in 1916, it became apparent that Germany intended to ignore all the laws of civilized nations at sea, and attack and sink not only enemy but neutral ships at sight, the necessity for more stringent anti-submarine measures became imperative. Two methods could be used: reduce the danger by increasing the patrols and arming merchant ships, or assemble ships in convoy and escort them.

SMALLER TARGETS

There were two schools of thought. One school claimed that if, instead of following the recognized routes on the high seas, merchant ships, being defensively armed, were widely dispersed, it would offer fewer and smaller targets to a submarine than if many ships were bunched together. The United States upheld this view. The other school advocated convoy, which would, of course, use numbers of cruisers and destroyers as escort, but these ships could ill be spared from duty with the fleet. The former method having proved unsatisfactory, the convoy system was decided on early in 1917; at no time did any of our convoys, except on a few occasions in the North Sea, have to meet an attack from surface ships.

In August, 1914, the German Naval Staff had little faith in the efficiency of submarines; and, as already stated, many experts in this country had little faith in

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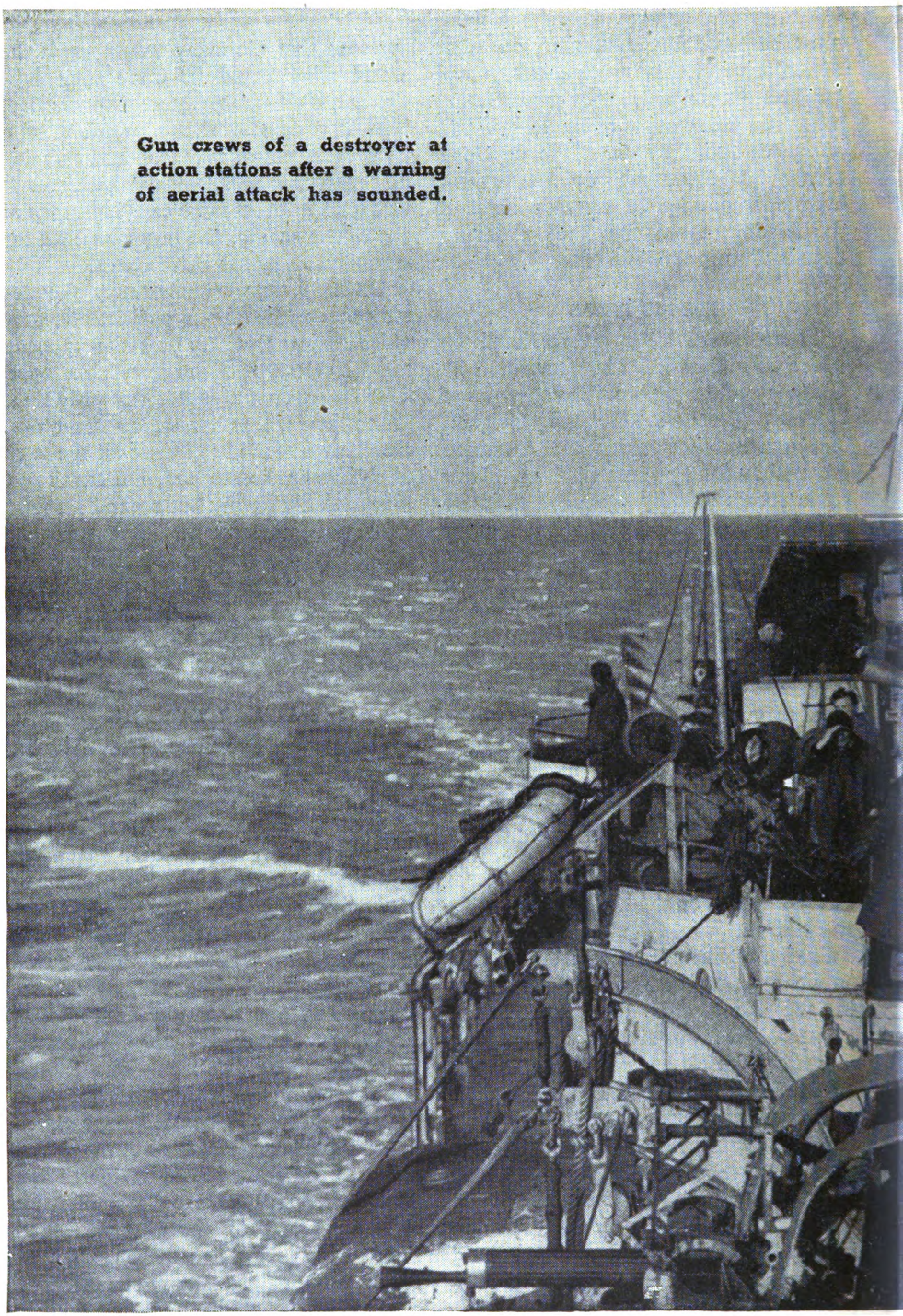

Gun crews of a destroyer at action stations after a warning of aerial attack has sounded.

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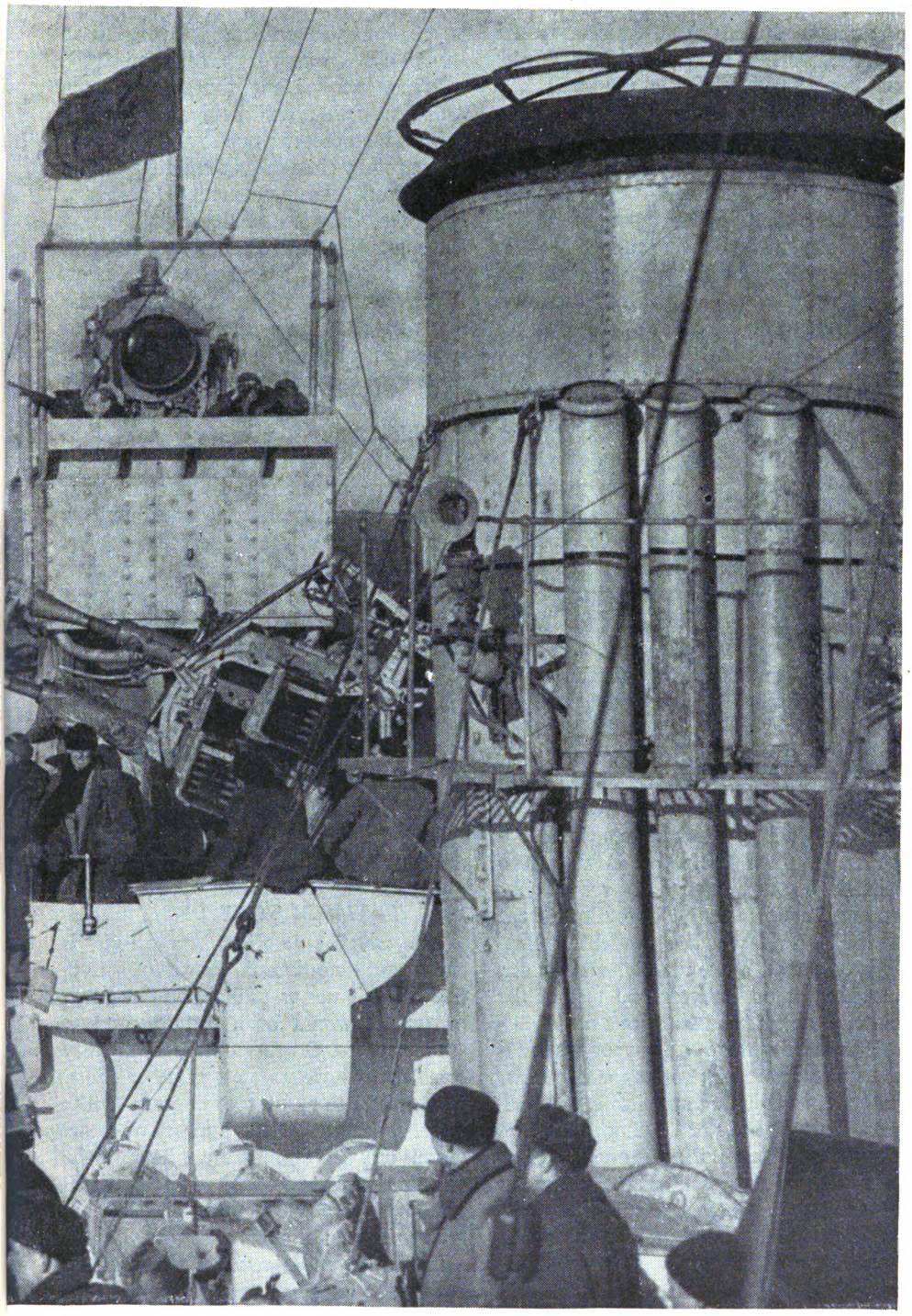

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the convoy system as an antidote to the submarine. But at the outbreak of the Second World War the Germans had faith in, and launched, a submarine campaign without delay; and we had faith in, and started, the convoy system; the immediate introduction of the latter was possible owing to the foresight of the Admiralty in having organized pre-war courses of instruction for officers of the Merchant Navy, and for naval officers who were to be in charge of convoys.

CAREFUL TRAINING

An efficient convoy system depends on a sufficiency of escorting vessels and aircraft, and on careful training: training not only of the gun crews of merchant ships, but of the officers in the art of station-keeping at sea—that is, keeping the correct distance from the next ship in line during darkness as well as in daylight. Accurate station-keeping is very important, and depends not only on the vigilance and skill of those in charge on the bridge but of those in the engine-room.

No amount of training will, however, ensure success if the force available for escort is insufficient. In the war of 1914-18 the force was insufficient, but the lesson so hardly learned was soon forgotten by those misguided idealists who worked so unceasingly to reduce our strength at sea. At the beginning of the Second World War our available escorting force was, consequently, inadequate, resulting in unfair wear and tear of the material and personnel of our navy.

The disadvantage of a convoy system is the great delay, and corresponding extra expense, in bringing supplies from overseas. Delay at the start, owing to all ships having to wait until the last one is loaded; delay on the voyage, owing to the speed of the convoy being regulated by the speed of the slowest ship, and also owing to the extra distance to be steamed on the circuitous routes which must be followed; delay in unloading, owing to so many ships arriving at the same port.

When there is any shortage of commodities, think on these things. The ships which escort a convoy are not only sloops; every class of ship and many types of aircraft are employed. Destroyers, corvettes, sloops, submarines, armed merchant cruisers, trawlers, cruisers, and even battleships are used according to the circumstances prevailing. The constitution and disposition of the armed escort, and the use made of aircraft, must, of course, depend on the speed of the convoy; the length of the voyage; the localities through which the convoy is passing; the proximity of land; the anticipated form of attack to be met, whether surface raider, submarines or aircraft; or a combination of these and other details.

It is uneconomical if a convoy consists of slow ships as well as fast ships, because the speed is that of the slowest. So far as circumstances permit, fast and slow ships form separate convoys. The slower the convoy speed the greater is vulnerability. Speed is a great safeguard; yet, unfortunately, many of our cargo-carrying vessels are designed for a maximum speed of only nine or ten knots, which owing to station-keeping and winds often reduces the convoy speed to five or six knots.

WASTE OF EFFORT

The number of ships in a convoy is also a consideration. A convoy of thirty-five ships is not as difficult to handle or protect as would be a convoy of, say, seventy ships. On the other hand, a very small convoy would be a waste of effort. The greater the total area covered by the convoy, the greater the number of escort vessels required; on the other hand, if the ships steam in column and the columns are kept very close together, there is greater chance of some ship being hit by a torpedo fired at random through the convoy, and during dark hours the

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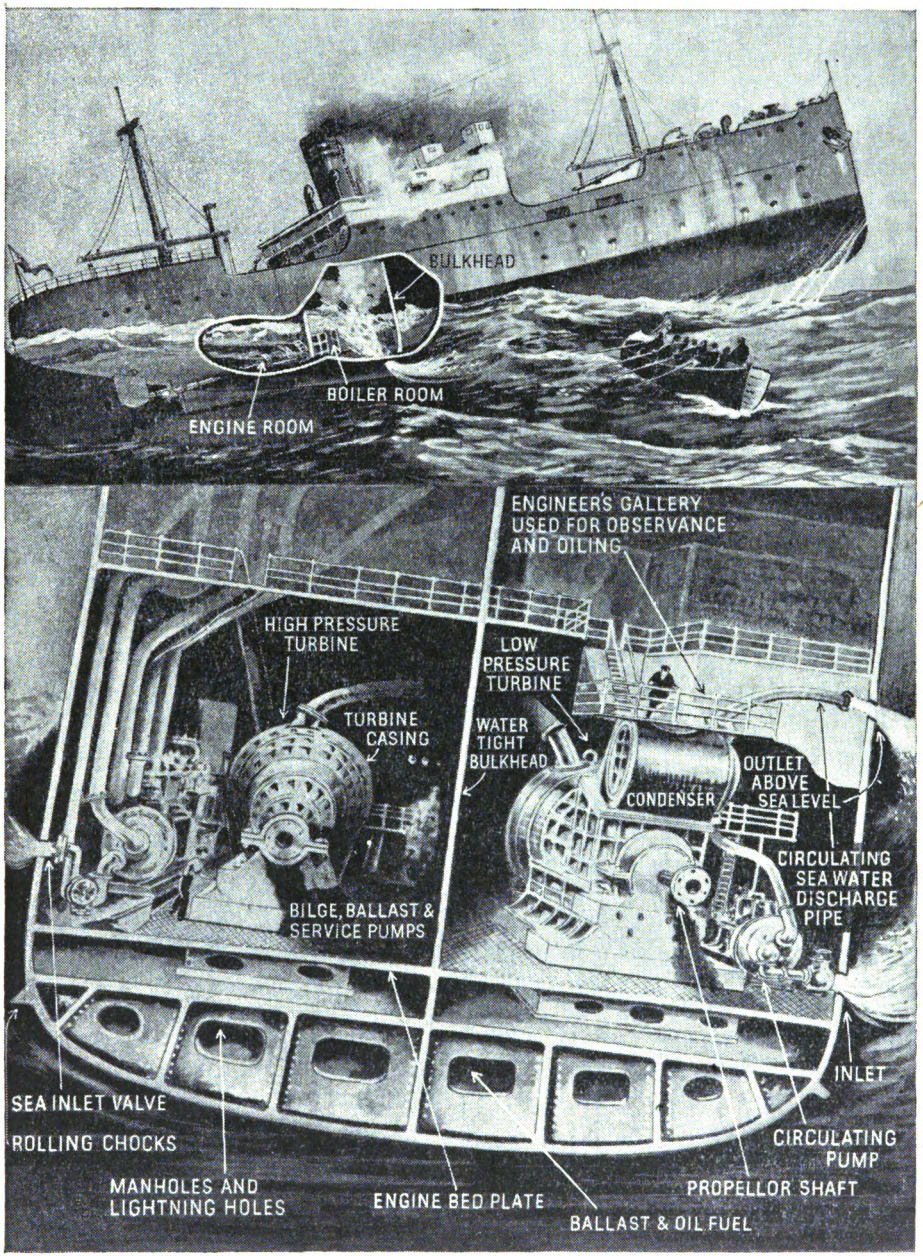

HOW MERCHANT SHIPS ARE SCUTTLED

Merchant ships use sea water for cooling steam in condensers and for other purposes. This water is let into the ship through inlet valves or seacocks. If it is desired to scuttle a ship the inlet valves are closed and the pipes are broken between the valves and the condensers. When the seacocks are again opened the ship fills with water. Time bombs can be used to aid destruction

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chances of damage owing to collision are greater. In distant waters, where the danger from submarines and aircraft is reduced to a minimum, the ocean escort may consist of one large ship only, probably occupying a position near the centre of the head of the convoy.

The escorting vessels are fitted with listening devices for locating the presence of a submarine, and radiolocation is invaluable for the detection of aircraft. Owing to the disturbance caused by the propellers of so many ships, the detection of submarines is rendered difficult. At night an enemy submarine may lie, with engines stopped, on the surface, in which case a listening device is of no use.

An attack by a surface raider can be beaten off only if the escort vessels carry guns sufficiently powerful to engage her successfully; for this reason a convoy may be accompanied, or covered, by one or more battleships or cruisers. Submarines also often form part of an escort.

Attacks may be made by a single submarine, or by a pack of three to five. When hunting in packs it is usual for one of them to stalk the convoy in daylight, and then to call up his friends in readiness for an attack after dark. A submarine attack calls for high skill and unerring judgment not only in order to place the submarine in the correct position for attack, but having reached that position to aim the torpedo correctly. Meanwhile the escort must be evaded, and after the attack the counter-attack must be met.

THE SLUGGARD

At dawn the commodore of the convoy casts a keen eye around his flock, and a signal, "Where is number twenty-five?" may be flashed. The sluggard may be twenty miles astern, or away on the beam, but must be found and herded in.

Attacks by bombing aircraft can, of course, only be made within the radius of action of the nearest aerodrome. These attacks, if pressed home, are serious, especially if made when fighter aircraft are not available for defence; even so, many are the successes that have been achieved not only by the A.A. gun crews of the escorting vessels but by those of the merchant ships. Some merchant ships, moreover, have been fitted to carry fighter aircraft.

FAST MOTOR BOATS

In narrow seas attacks by fast motor boats may be encountered. At night these small craft are a very real menace, but in daylight our gunners are usually competent to deal with them. Our own motor torpedo boats may join a convoy on approaching the coast, at which time it also has the advantage of additional aircraft protection. Mines—contact, magnetic or acoustic—constitute another danger in shallow waters.

Reference has been made to the occasional use of a battleship as convoy escort. Battleships are not, however, designed for this particular purpose. A navy must consist of many categories of ships of all sizes. A battleship is the strongest unit of a fleet of today. The main points aimed at in designing a battleship are: heavy armament with a long range, massive side armour and deck armour to protect the vitals from projectiles fired from heavy guns and bombs from the air; underwater protection to withstand torpedo attack; and as high a speed as can be produced without sacrificing strength; a ship, in short, which is strong enough to take her place in "the line of battle" when faced by the most powerful fleet in existence. In Nelson's day the strongest warship was called a "ship of the line," a term which has since given way to "capital ship."

The term "capital ship" is not necessarily synonymous with "battleship." If battleships were abolished, heavy cruisers would automatically become capital ships,

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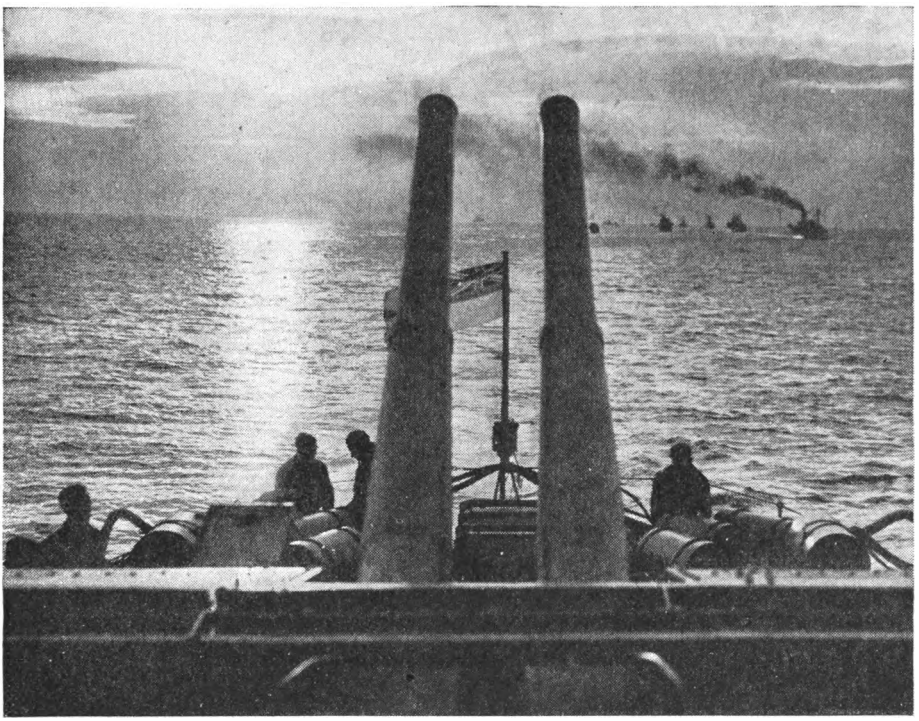
and so on. Suggestions have, from time to time, been made that, owing to expense and to the undesirability of having too many eggs in one basket, battleships should be abolished, or drastically reduced in size. So far as the security of our Empire is concerned we could never agree to the abolition of the battleship; we could agree to a reduction in size, provided all other nations fell into line.

It goes without saying that our Empire, which depends on the sea for its existence, must have ships which are strong enough to meet any known form of attack from sea or air; and they must be large enough to possess those sea-going qualities necessary for service anywhere in the Seven Seas, in whatever weather may be encountered. Our ships must be large enough to go where required to go, so that a sufficient force can be in the right place at the right time. Herein lies the basis of naval strategy. If battleships were abolished, the remaining units of the fleet would be rendered innocuous if faced by a fleet containing battleships.

The battleship is the king-pin of the defence system of our Empire. A fleet of battleships forms a solid rampart of sea power, and acts as protector of the weaker units. The battleship is the last and final word—our sure shield. Let us never forget that "The Sea is our Life," and that it is owing to the fine and fearless seamanship of all those "that go down to the sea in ships and occupy their business in great waters," that we have been saved from want, and our cause from disaster.



KEEPING THE SEA LANES OPEN

This sunset scene typifies the constant watch kept by the Royal Navy over British convoys. The anti-aircraft guns are ready and some of the crew are standing by the depth charges

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CAPITAL SHIPS IN LINE AHEAD

In wartime the best fighting formation for a battle fleet is in line ahead. This gives an uninterrupted arc of fire for each ship. It is, however, very vulnerable to torpedo attack

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CHAPTER 14

Fleet Battle Tactics

Conditions for fighting. Avoiding action. Organization of a battle fleet. Line ahead. Torpedo attack. Equal speed manœuvres. Deployment. Opening or closing range. Attack from the air. Simultaneous attack from two directions. Danger of eccentric tactics. Chasing. Night actions.

THE battleship is the most expensive, the most heavily armed and defensively equipped vessel afloat. Normally, it is designed to form a unit in a battle fleet; and, by working in conjunction with other battleships, to form a strong force able to impose its will on all ships using the surface of the sea. In fact, briefly, the functions of a battle fleet are to support and protect friendly vessels, and to threaten and render impotent the sea forces of an enemy.

The somewhat limited fuel capacity of a battleship usually restricts its sphere of operations to waters more or less in the vicinity of friendly shores and naval bases. In fact, the waters in which our battleships are most generally to be found are the North Sea, the Eastern waters of the Atlantic, the Mediterranean and, not improbably in the future, Eastern waters not far from Singapore or the Philippines.

Until met and defeated by an enemy's fleet our battle fleets should command the surface of the Atlantic and Mediterranean to the extent of preventing any serious oversea attack on our bases, denying extensive convoy to enemy transports and merchant vessels, and causing any minor naval operations that he may wish to undertake, to be fraught with a considerable element of danger.

It is true that we have seen in the Second World War how the Germans, instead of using their battleships in the normal way, have employed them and their battle cruisers to carry out work that hitherto has usually been assigned to armoured cruisers. But the experiment has, so far, met with only meagre success, as evidenced by the fate of the *Bismarck* and the pocket battleship *Admiral Graf Spee*, and the enforced seclusion of the *Scharnhorst*, the *Gneisenau* and the *Prince Eugen*. Mr. Churchill in his magnificent trilogy *The World Crisis* dramatically called attention to the superlative value of a battle fleet by stating that Sir John Jellicoe was the only man who could have lost the war of 1914-18 in an afternoon.

IRREPARABLE DISASTER

To an island nation the defeat of its battle fleet, in these days, is an irreparable disaster. This, however, was not the case in Nelson's time; if Trafalgar had been lost and the fleet under his command annihilated, we had in reserve ships equal in number to those which fought that memorable battle. But nowadays, battleships are so costly and take so long to construct that the number possessed by a country must, of necessity, be strictly limited. The whole of the battleship strength is therefore bound to be deployed when the day for action arrives: a day, indeed, of stupendous importance.

This being so, the tactics employed in a battle fleet action are of paramount

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importance. In the first place, such a battle must be fought in conformity with the main strategy of the war. Generally speaking, the admiral who has command of the surface of the sea has no urgent reason to engage his opponent. As matters stand, the seas are his highways and will continue to be so until command is wrested from him. His opponent, on the other hand, is daily suffering from the constriction imposed on the movements of his vessels, and his country is probably undergoing an increased economic starvation. It is, therefore, imperative for him to attack to gain command of the sea from his enemy at the first opportunity.

UNWILLING TO FIGHT

Neither admiral can force an action if his opponent is unwilling to fight. But since Admiral A, who holds command of the sea, must prevent Admiral B from making free use of the oceans, he must fight B should he venture out into waters over which A desires to retain control. But since he cannot force B to leave harbour and put out to sea, the initiative in forcing an action lies with the weaker (B) and not the stronger (A) fleet. The admiral of the weaker fleet can remain in harbour and tune his ships up to the last degree of efficiency, and clean boilers and bottoms so as to be able to steam at maximum speed on the day that he has selected to come out and fight. The admiral of the fleet holding command of the sea cannot foresee the day when B will venture out, so he must be ready every hour of every day and night to put to sea and meet his opponent with the ships of his fleet only in an average state of efficiency, and when some, perhaps, are absent for docking and overhaul.

It may further best serve the needs of B to keep his fleet in what is technically known as "in being," ready to pounce should A's fleet suffer loss or damage from the attack of submarines or skilfully laid mines. Although in some respects advantageous, such a policy is bad for the morale of the officers and men. If persisted in over a too great length of time it is apt to breed a sense of inferiority, which is fatal to success in the day of battle.

We have as an example of such a policy the failure of the German High Sea Fleet to seek action with our Grand Fleet during the war of 1914-18. An engagement was systematically shunned, while attempts were made by the enemy to reduce the strength of our fleet by the use of submarines and mines. This had a just reward in disaffection and mutiny in the German Navy.

In the Second World War Germany has found herself too weak to challenge Britain's battle fleet; and Italy foolishly emulated the old German tactics of refusing action, hoping thereby to reduce our strength not only by submarine attack but also by the use of E-boats and aircraft. The result has been as disastrous to her navy as it was to that of Germany.

Japan at last has thrown off her cloak of neutrality and has declared war on the Allied Powers. This has once more brought the probabilities of a major battle fleet action to the fore. It is impossible to forecast the trend of events in the Far East, pending the resuscitation of the United States' fleet. Suffice it to say that, if possible, that country should manœuvre to fight the action as far south as possible, so as to ensure that any Japanese ship that may be damaged should have the maximum distance to travel to its repair base.

DESTRUCTION AND PROTECTION

The action when fought will have in view the destruction and protection of convoys. Presumably the United States' forces will advance from the south with their aerodromes well behind them and push the Japanese out of the territories they have raided. This will lead to a clash

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between the cruiser forces: these will seek the protection of their battle fleets: then will come the greatest sea fight that the world has ever seen.

It is not, however, the strategy of such a policy that we have, for the moment, to discuss; but, *en passant*, it is necessary to note that, more frequently than not, the battle fleets of opposing nations are not both desirous of fighting a fleet action. The consequences of failure are so tremendous that the Powers directing the fleet, which on paper may be the weaker, are apt to extend a palsied and restraining hand and hamper the free use of the battle fleet; an action which is bound to have a far-reaching effect on the tactics of the two fleets. Before, however, embarking on a description of the tactics used in battle, it is necessary to pave the way by explaining how a battle fleet is organized for this purpose.

DIVISIONS AND SUBDIVISIONS

The most convenient manner in which to organize battleships for peace time cruising, or war time fighting, is in divisions, usually of four ships each. These divisions are, in turn, split up into subdivisions of two ships each. Since all the ships of a fleet, owing to age of construction, do not possess the same speed it is advisable to have each division composed of ships of the same speed.

Both for brevity and convenience of exposition we will assume, in the diagrams and descriptions that follow, a fleet to be composed of eight ships only. There will, therefore, in such a fleet be two divisions, each of four ships, and four subdivisions of two ships each.

The most convenient way to arrange a battle fleet for cruising in peace time is in a single line, each ship following its next ahead as closely as practical experience has shown to be the best. To prevent visual signalling being masked by smoke the "divisions" are frequently "disposed" abreast of each other. All signals are then repeated by the leaders of divisions and can be clearly seen by the rear ships of the fleet.

We will assume each ship to be six hundred feet in length, and the distance from the stem of one ship to that of its next astern to be two and a half ships' lengths, or 1,500 feet, that is, 500 yards. And since a sea mile is 2,000 yards, the distance from ship's stem to ship's stem is a quarter of a mile.

Fig. 1 shows a fleet of eight ships in

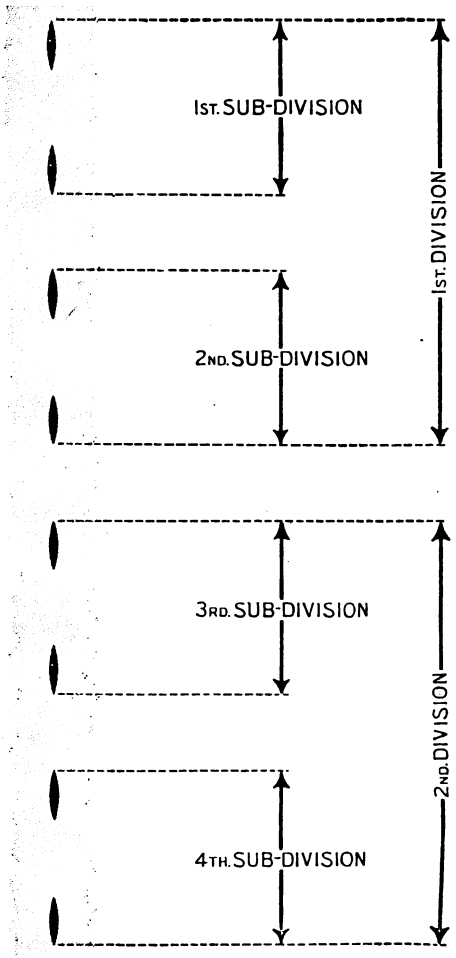

Fig. 1. *A fleet of eight ships in line ahead, organized in divisions and subdivisions*

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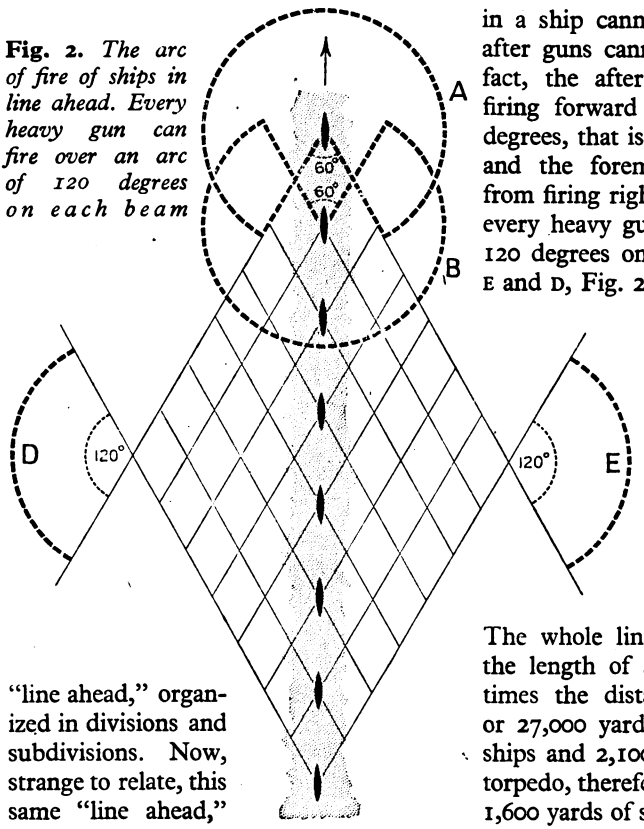

Fig. 2. *The arc of fire of ships in line ahead. Every heavy gun can fire over an arc of 120 degrees on each beam*

"line ahead," organized in divisions and subdivisions. Now, strange to relate, this same "line ahead," as it is called, has been found the best formation in which to fight, both with the old sailing line of battleships and also with our modern dreadnought types. One might well have expected that, with the increased mobility afforded by steam, a more complex arrangement might have found favour. But the fact that in line ahead an uninterrupted arc of fire is afforded to each ship has caused the line ahead formation to be adhered to even at the present day. Fig. 2 deals with this question of arc of fire, a matter of supreme importance.

A ship must have some form of superstructure erected on its upper deck. Masts, or at all events a mast, must be installed; funnels, ventilators, chart houses and control positions are essential. Owing to these impediments, the guns forward in a ship cannot fire right aft, and the after guns cannot fire right forward. In fact, the after guns are masked from firing forward through an angle of 60 degrees, that is, 30 degrees on each bow, and the foremost guns are prevented from firing right aft to a like extent. But every heavy gun can fire over an arc of 120 degrees on each beam, as shown at E and D, Fig. 2. When fighting an action the admiral tries to keep his enemy within this arc of firing.

Although the line ahead is the best formation for fighting, it is not a good one for cruising in wartime. Fig. 3 shows how vulnerable ships are to torpedo attack when disposed in this manner. The whole line of ships is eight times the length of a single ship, plus seven times the distance between each ship, or 27,000 yards; that is, 1,600 yards of ships and 2,100 yards of blank space. A torpedo, therefore, fired at such a line has 1,600 yards of ship to hit and 2,100 yards of space in which to miss. The chances of a hit to a miss are therefore as sixteen is to twenty-one: or roughly, as two is to three. Out of every five torpedoes fired, three should miss and two should hit. This percentage of probable hits entails a grave risk. To minimize this, the ships are disposed when cruising in wartime as shown in Fig. 4. Here it will be seen that the starboard beams of the right-hand pair of ships, and the port broadside of the left-hand pair, are the only ones exposed to a broadside by torpedoes. The same principle applies when disposing merchant ships in convoy.

It may be thought that if all the ships were in a single line abreast of each other, even greater safety might result. This is theoretically true. But the practical difficulties attending station-keeping when

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ships are cruising have led to its not having been adopted.

One of the main preoccupations of an admiral when fighting an action is to keep the speed of his ships as nearly as possible constant, and the course of the ships as steady as circumstances permit. By so doing, the gun fire is least affected. If either speed or course has to be altered, the gunnery officers should be warned, and the *rate* of alteration made known to them so that they can make the necessary alterations in adjustment to the gun-sighting apparatus.

It is, of course, only natural that ships of the huge tonnage of modern battleships must take a considerable time to gain and lose speed when the speed of the engines is either increased or reduced. This time, among other factors, varies with the actual displacement of the ship; and, since the tonnage of all ships in a fleet is rarely the same, any fortuitous alteration of speed of the fleet is liable to throw the ships out of accurate station. When in line ahead this leads to a certain amount of concertina-ing, ships forging ahead or dropping astern, until the exact speed has been arrived at by all the ships.

In order to avoid this disturbance, all manœuvres that are undertaken in the face of an enemy are carried out by what are called *equal speed manœuvres*; that is, they permit any formation to be altered, and a new one taken up without the speed of the ships being in any way affected, either by each ship in turn following its next ahead in a follow-my-leader fashion, or by all the ships putting over their helms at precisely the same moment.

Fig. 5 shows how ships in line ahead can change their formation to line abreast at constant speed, and then proceed in the original direction. The ship leading the line turns eight points (90 degrees) either to starboard or port, whichever the admiral may consider to be, at the moment, the more convenient, as at (A). The others follow their leaders around; and then, when all are in line (B), the whole put over their helms and turn up into line abreast.

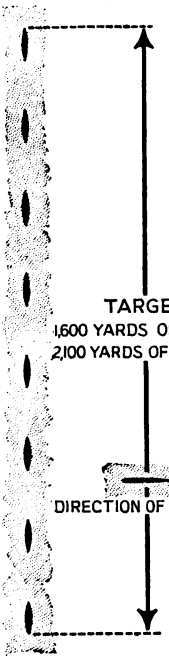

Fig. 3. *Ships in line ahead are very vulnerable to torpedo attack.* (*See text on page 256*)

Fig. 6 shows how to turn back into line ahead. According to the signal made, the port or starboard ship keeps straight on; all the others turn eight points towards her (A), each turning up behind its next ahead as it arrives at the turning point.

We have seen that the best cruising formation in wartime is with one or more divisions abreast of each other. In order to engage an enemy, it is necessary to change from this into line ahead. Fig. 7, (A) and (B), shows how a fleet of eight ships would do this. The ship which the admiral intends should eventually head the line, leads its subdivision straight on, and the leading ships of the other subdivisions turn together towards this flank subdivision. The remaining ship in each subdivision follows its leader. Each ship, as it arrives, turns up behind its next ahead.

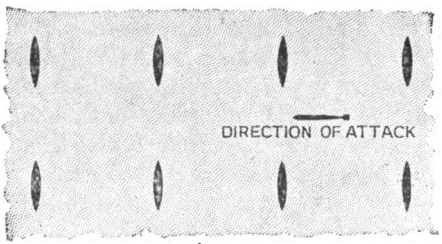

Fig. 4. *This is the most usual formation used for cruising in wartime, it being much less vulnerable to a torpedo attack from the beam*

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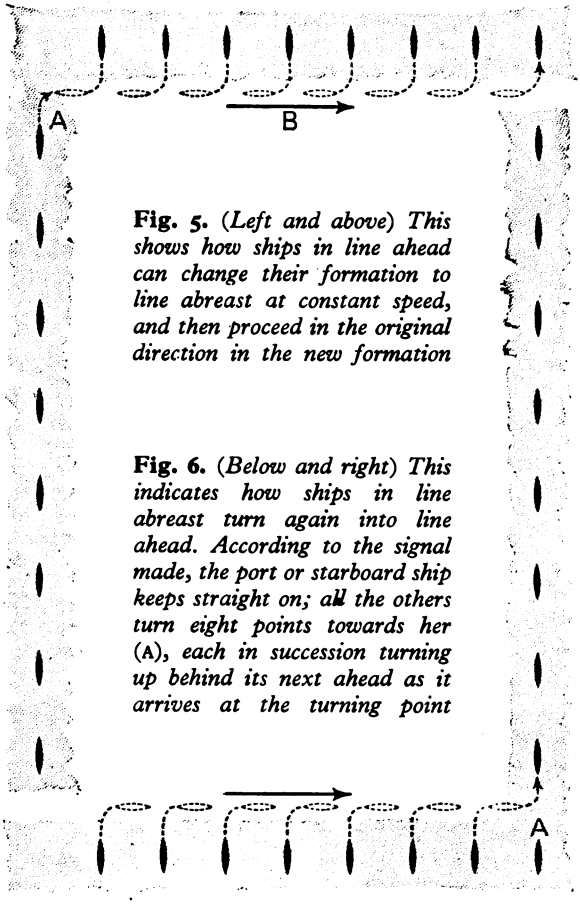

Fig. 5. (*Left and above*) *This shows how ships in line ahead can change their formation to line abreast at constant speed, and then proceed in the original direction in the new formation*

Fig. 6. (*Below and right*) *This indicates how ships in line abreast turn again into line ahead. According to the signal made, the port or starboard ship keeps straight on; all the others turn eight points towards her* (A), *each in succession turning up behind its next ahead as it arrives at the turning point*

This change from a cruising to a fighting formation is called "deployment."

Unequal speed manœuvres, during which some ships increase to full speed and others drop to dead slow, occupy less time and space than those carried out at equal speed. There is no objection to the use of unequal speed when not in the face of an enemy, or when there is sufficient time to bring the fleet into order before opening fire. A typical case of this class of manœuvre is that in Fig. 8. Here, if an enemy is reported a long way off, the fleet can be deployed by the use of unequal speed until the enemy is on the verge of being sighted, and the manœuvre is completed by an equal speed movement.

If, as in Fig. 8, an enemy fleet is reported as being in a direction indicated by the large arrow, the admiral would first wheel his fleet as shown until the ships arrive at A-B. This is an unequal speed manœuvre, as the pivot ship must reduce speed; the wing ship increase to full speed, while the other ships accommodate their speed according to their distance from the pivot. When the fleet has wheeled so that its ships are advancing directly towards the enemy, it can continue on this course until shortly before visual contact is made, as at C D_1. The ships can then be turned into line ahead, the best formation for fighting, by the equal speed manœuvre explained in Fig. 7.

The position of greatest tactical advantage that a fleet can attain is when the admiral has succeeded in throwing it across the path of an advancing enemy, as in Fig. 9. The guns of all the ships which are within range of the point B can then open fire on the leading ship of the enemy's line. There are only two courses open to B; either he must turn all his ships away simultaneously and so temporarily break off the action, or he must turn his ships in succession as they arrive at B. In this case, each ship in turn gets badly straffed while turning, by a number of guns all of which have discovered the exact range of the turning point, as in Fig. 10. This is a condition of affairs that may well spell complete disaster for a fleet. Incidentally, twice at the Battle of Jutland, Sir John Jellicoe threw his fleet right across the path of the enemy, and in each case the enemy immediately turned away and broke off the action.

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After an action has commenced, and for so long as it continues, broadside to broadside, there is only one class of manœuvre likely to be used: namely, one that allows of opening out or reducing the range. If an admiral notices that the enemy is inflicting greater damage on his ships than the latter are doing to the enemy, he may wish to open out the range, should he consider that his gunnery will be more effective at the increased range. In order to do this with a minimum of disturbance to the gunfire of each ship, a "sidling" movement is embarked on. In this, each ship will turn a very few degrees towards or away from the enemy, and after the requisite distance has been arrived at each will turn again to the old course, as shown in Fig. 11.

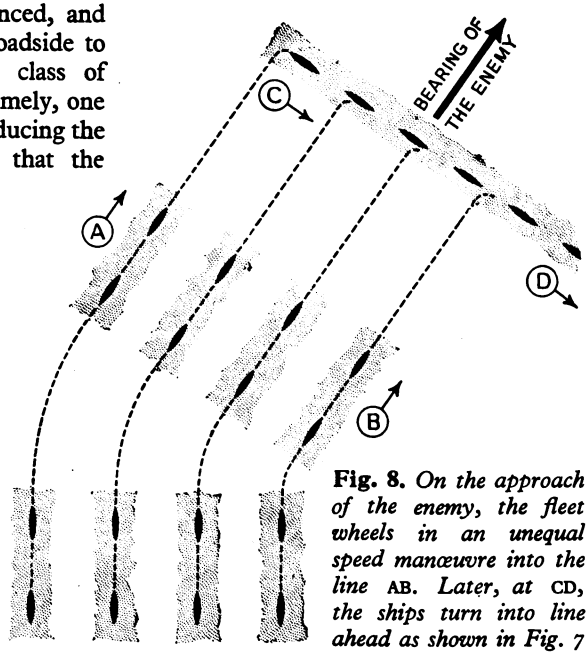

Fig. 8. *On the approach of the enemy, the fleet wheels in an unequal speed manœuvre into the line* AB. *Later, at* CD, *the ships turn into line ahead as shown in Fig. 7*

It should be noted that the distance SF is longer than the distance SR; so this manœuvre can only be carried out by a fleet which is faster than its opponent. On the other hand, one fleet, though considerably faster, can never steam ahead of another; since the slower fleet has only to circle, as shown in Fig. 12, and force the other to expend its extra speed in steaming along the arc of a circle of greater diameter. So far, we have only dealt with the manœuvres that are associated with gunfire. We have now to consider the intrusion of the destroyer and also modern aircraft into the tactics of a battle fleet.

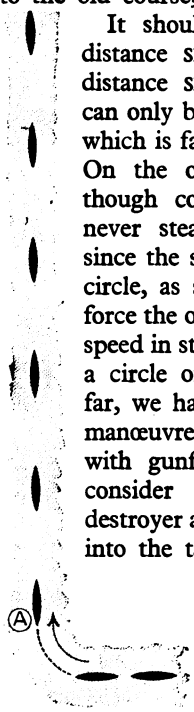

Fig. 7B. *Here the ships of the 2nd Division (in Fig. 7A) are turning at* A *into line behind those of the 1st Division*

A battleship suffers from a most important disability, namely, its vulnerability to below-water attack. In Nelson's day the battleship feared nothing which floated on the water, and, so far as offence and defence were concerned, it was self-sufficient. In these days a single torpedo may either sink a battleship or cause one or more of her compartments to be

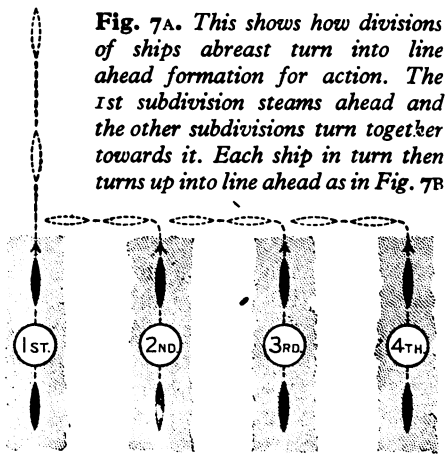

Fig. 7A. *This shows how divisions of ships abreast turn into line ahead formation for action. The 1st subdivision steams ahead and the other subdivisions turn together towards it. Each ship in turn then turns up into line ahead as in Fig. 7B*

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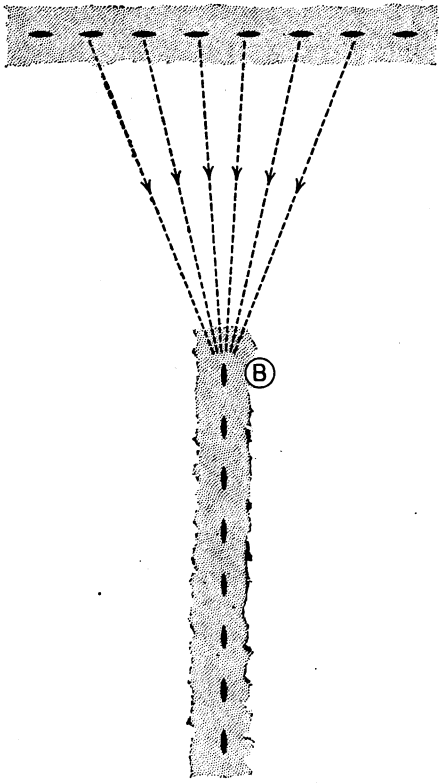

Fig. 9. *This shows the great tactical advantage of placing a fleet in line ahead across the path of the enemy. All guns can then bear on the enemy's line* (B). *The enemy must either turn all his ships away simultaneously or turn them in succession at* B

flooded. The water thus taken into the ship is bound seriously to affect her stability, her speed and also her efficiency as a gun platform. (*See* Chapter 6.)

In order to assist to ward off such an attack, as well as to inflict like damage on the enemy during a fleet action, destroyers are kept in company with the fleet. These remain normally on the off-side of their battleships, where they are afforded a certain amount of protection, but are ready at any moment, if ordered, to steam through the line and carry out an attack on oncoming destroyers or a torpedo offensive against enemy battleships.

Fig. 13 shows an instance where a fleet is attacked by destroyers sent out by fleet B. As soon as the commencement of the attack is observed, A's destroyers immediately steam out to stem, or repel, the attempt by engaging the advancing vessels with gunfire. The two flotillas meet and engage somewhere about midway between the two fleets; which, in Fig. 13, are taken as being 18,000 yards apart. Even supposing that the attackers were to press right up to, and in among, the opposing destroyers, they would only get within 7,500 yards of A fleet, and the torpedoes would have this long distance to run; so the attack would have been to a great extent foiled.

A position such as that shown is by no means a good one from which to fire torpedoes; this is more clearly illustrated in Fig. 14, where we see plotted out the direction in which the torpedo would have to be fired in order to hit a moving ship. A torpedo takes about thirty times as long as a projectile to travel a given distance, so it cannot, like a projectile, be fired in the direction of a moving ship.

If the torpedo, for instance, were fired in the direction TX it would take eight minutes to reach the point X. In the meantime the ship would have moved on

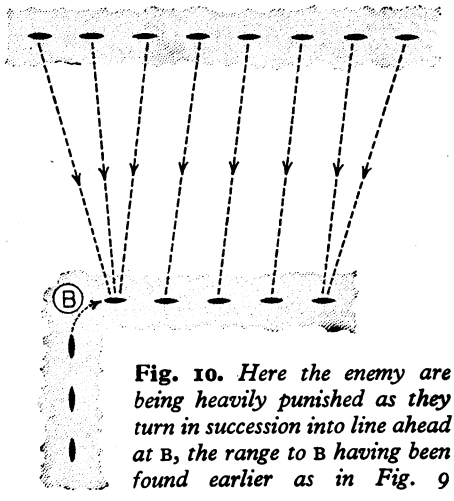

Fig. 10. *Here the enemy are being heavily punished as they turn in succession into line ahead at* B, *the range to* B *having been found earlier as in Fig. 9*

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to Y, nearly three miles farther on, so the torpedo would pass harmlessly astern of the ship. It should have been fired in the direction of TY, in which case both ship and torpedo would have arrived simultaneously at the point Y. If, in the meantime, the course of the ship had been altered some thirty degrees away from the torpedo, the range would have been increased and the torpedo's course would be nearly end-on to that of the ship. It could, therefore, easily be avoided.

The better place from which to bring off an attack is shown in Fig. 15. Here an attack from T would enable the torpedo to be fired along a line TY, and arrive at Y at the same time as the ship. Moreover, the torpedo would be running straight at the broadside of the ship. The position T, well ahead of the fleet, is not an easy one for the destroyers to reach when the battleships are steaming at a speed of some twenty-two knots.

It is, of course, apparent that our new thirty-knot battleships will be far more difficult to attack than the slower ones of twenty-two knots of previous design,

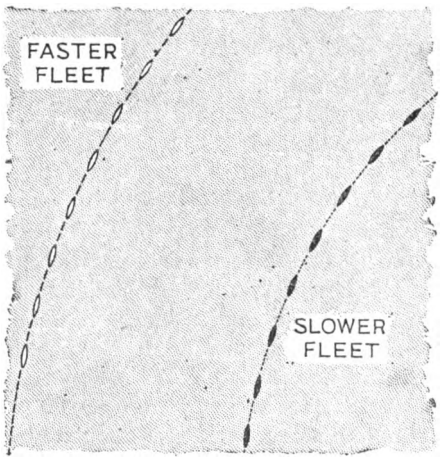

Fig. 12. *A faster fleet can never steam ahead of a slower one, as the latter need only circle in order to equalize matters. The faster fleet will expend its extra speed steaming along the arc of a circle of greater diameter*

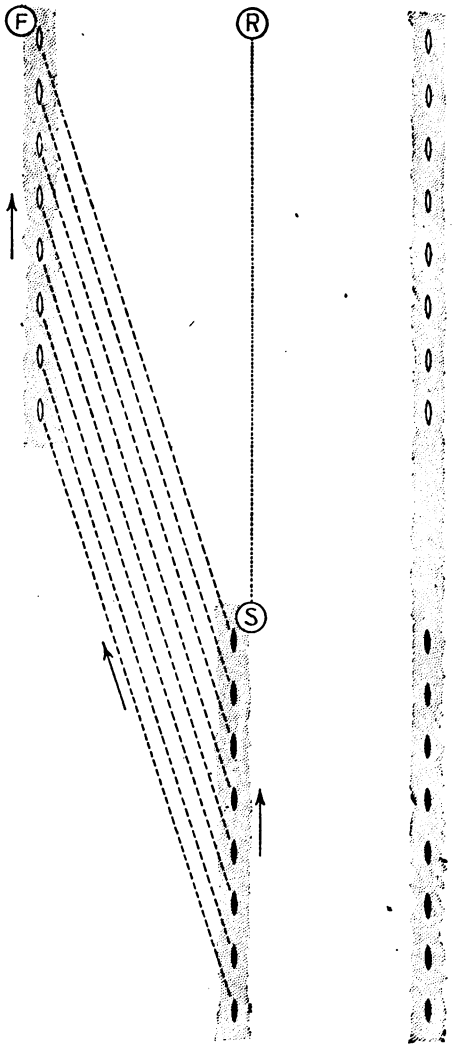

Fig. 11. *This is how a faster fleet, by a sidling movement, can open out the range and make hits by the enemy more difficult to obtain. Each ship's gun fire is not much disturbed*

unless the speed of the torpedo itself can be proportionately increased.

Although during the Second World War we have had plenty of experience of attack from the air on single ships, we have had none of attack from the air during a fleet action. We have, therefore, only surmise to go on. It is easy enough to

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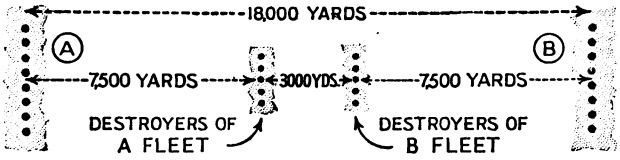

Fig. 13. *The destroyers of* B *fleet are attacking* A *fleet. The destroyers of* A *fleet steam out towards them and the two flotillas are engaged about half-way between the fleets. A torpedo attack by* B*'s destroyers is unlikey to succeed at such a range*

visualize the danger to the ships from such an attack; but it is impossible without further experience to foresee, and make allowance for, the practical difficulties that the aircraft will meet in carrying out the attack.

When considering this problem we should not fail to bear in mind its analogy to surface attack by destroyers, giving at the same time full value to the fact that the rate of approach of the plane is some ten times as fast as that of the destroyer. It is this great superiority in speed that is responsible for the increased danger of attack from the air with torpedo. The planes can rush in to a much closer distance than the destroyer without being so long under gun-fire. At the same time the plane is extremely vulnerable to attack when swooping down and running at its low level of some thirty feet above the water while getting into position to fire its torpedo. This was well shown when, in the attack on the *Scharnhorst* and *Gneisenau* in the English Channel, the whole of our Swordfish planes were lost.

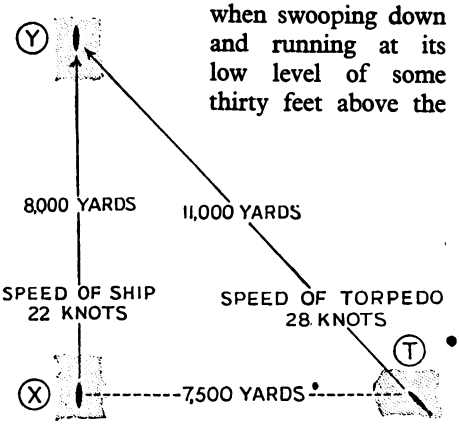

Fig. 14. *The firing of torpedoes from the point* T *would be inadvisable, owing to the relative speeds of the torpedo and ship. The ship would be at* Y *when the torpedo reached* X

In the absence of any practical experience of an attack on a fleet, the best we can do, in order to get a fairly clear conception of the principles involved, is to take some simple figures and plot out an imaginary attack as in Fig. 16.

Here we see that there is a very great advantage in firing a torpedo at 300 yards distance at X, over one at 1,000 yards at Y. The angle BXA is so large that a ship should certainly be hit, whereas the angle BYA is so much smaller that a miss is probable. What it comes down to in practice is, if a torpedo is fired at a distance of 300 yards a ship can be attacked, if at 1,000 yards the target should be a line of ships. Added to this, the time taken by a torpedo to run 300 yards is eighteen seconds; so that a ship desiring to take avoiding action would hardly have got her helm over before the torpedo struck her. Whereas at 1,000 yards she would have a whole minute, and could turn through a considerable angle.

AVOIDING ACTION

A plane flying at 300 miles an hour would cover the distance between the two fleets in approximately one and a half minutes: a destroyer steaming at thirty knots would take ten times as long to cover this distance. If an air attack from over the enemy line was imminent, it is unlikely that this would be detected by the ships in time for them to take the necessary avoiding action; it might well come as a bolt from the blue.

It would seem that the best position for protection against aircraft would be

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somewhat as shown in Fig. 17, where one destroyer is approximately on the beams, both starboard and port of each ship, and one ahead and one astern of the line, so as to act as a protection should the ships proceed to turn through ninety degrees.

AERIAL PROTECTION

The protection provided by fighter aircraft can never be regarded as complete under all conditions of attack. The fighters can only be expected to destroy a percentage of the attacking planes; a few are certain to avoid destruction, and these can complete the attack. If, say, twenty-five planes attack and the fighters account for twenty, there will be five left which may well sink the ship. A lot of nonsense was written at the time of the loss of H.M.S. *Prince of Wales* and *Repulse* off Singapore. Complaints were made that the ships were not defended by aircraft. It is extremely improbable that an aircraft-carrier (itself very vulnerable) could have supplied sufficient protection to the two battleships throughout the daylight hours that the ships would have been at sea. The number of planes used by the enemy boded ill for successful defence. The main point clearly brought out was that it was a gross strategical error to have sent two isolated battleships to the centre of amphibious operations within easy reach of enemy aerodromes. They were quite useless for taking part in the operations then in progress, and were bound to be sunk in the course of a day or two.

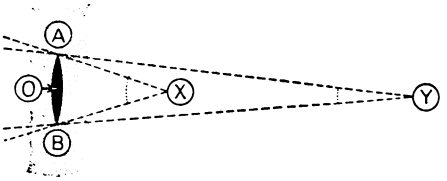

Fig. 16. *A torpedo fired from the air at* X *is more likely, owing to a bigger angle, to hit a ship than one fired at* Y *from a destroyer*

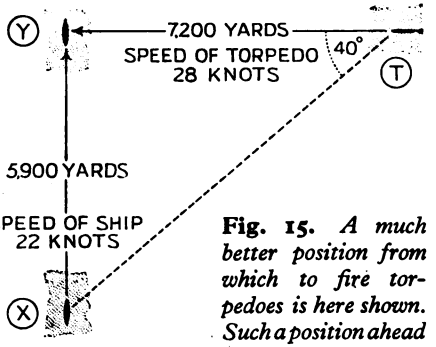

Fig. 15. *A much better position from which to fire torpedoes is here shown. Such a position ahead of the enemy is difficult to reach, owing to the increased speed of modern capital ships*

To sum up: attack from distances up to 300 yards can be made with more or less certain success on a single ship; over this distance the whole fleet will probably become the target with a three to one chance of a miss. Destroyers stationed abeam of a ship, say 700 yards, should hamper the attack by their gunfire, aided by the A.A. gunfire of the ships. The destroyers will still be out of range of the enemy's secondary armament.

Future experience will show whether avoiding action on the part of the ships is necessary, or if gunfire can be trusted to. The aircraft are extremely vulnerable when making their attack, and it is quite possible that guns may prove to be ample security in an attack against a thoroughly practised and disciplined fleet. The range of bombers is much greater, at present, than that of fighter planes, so that no reliance can be placed on the assistance of the latter in a fleet action. If avoiding action by ships is desirable, it can only be taken if the plane attacks at a greater distance than 500 yards.

It is impossible, within the space available, to trace the combinations that may result from a joint attack by destroyers and aircraft; sufficient to say that a combined attack with craft differing so greatly in speed as destroyers and aircraft would be most difficult to bring off;

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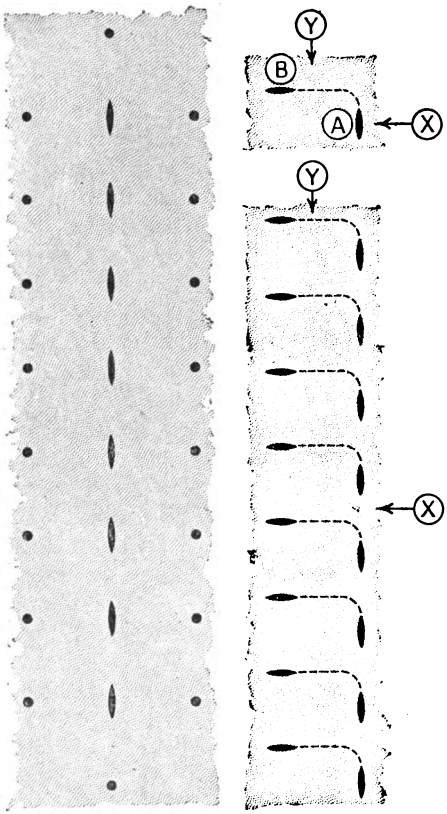
moreover, the same avoiding action should be able to defeat both types of attack.

Simultaneous attack by aircraft from two different directions is especially dangerous to a single ship. If, as in Fig. 18, a ship turns from an attack threatened from the direction X, she exposes her beam to an attack from Y. But, so far as a fleet is concerned, avoiding action exposes the flank ships only, as in Fig. 19.

It is not necessary to deal with dive bombers; such an attack can best be defeated by A.A. fire, since such planes are especially vulnerable when diving straight towards the A.A. guns.

There is one aspect of the subject, perhaps more strategic than tactical, which it is necessary to touch on. We must not discount the possibility that an enemy might bring a very large number, even thousands, of aircraft into a battle fleet action. This is not only possible but probable, should an action be fought in waters within easy reach of his aerodromes, as in the North Sea.

Much as our admiral might wish to fight his action in the Atlantic well away from the enemy's air bases, it is certain that an opponent weaker in battleships would elect to fight in waters where he could make full use of his air and torpedo craft. Of course, his fleet would incur a like danger; but being the weaker he can afford to gamble on the chance of his reducing our battleship strength to something nearer his own. It is well not to be led into such a dangerous trap.



Figs. 17, 18 and 19. *Fig. 17 (left) shows an effective destroyer screen against aerial attack. In Fig. 18 (top right), an individual ship is exposed to aerial attack from both* X *and* Y. *Fig. 19 (bottom right) shows that, when a whole fleet turns to avoid aerial torpedo attack, only the broadsides of the flank ships are threatened by attack from* Y

VULNERABLE POSITIONS

In our latest battleships, upper deck armour of considerable thickness has been installed, but there remain the control positions and communications which are liable to damage. A ship with damaged fire-control has probably lost some fifty per cent of her fighting efficiency.

It becomes a matter for serious consideration whether or not certain waters should be looked on as being unsuitable for battleship actions, and whether these should not be turned over to the protection of aircraft and smaller vessels. The Skagerrak was abandoned by our blockading cruisers during the rape of Norway, owing to the proximity of the German air bases. It does not require much imagination to extend this principle to our battle fleet in the North Sea.

That we cannot abandon the control of the waters in the North Sea is obvious.

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both from the necessity of dealing with attempted invasion and because of our coastal and other trade routes. But there is little doubt that the best way of maintaining that control will be by the use of a combination of smaller ships, torpedo vessels and aircraft.

There is always a possibility that the Germans might make a feint or even a full-dress invasion an occasion to reduce our battle fleet to a parity with their own by an intense air, submarine and E-boat attack. A venture that might be fraught with dire results to this country—this is a trap into which we should not fall. Our battle fleet will have plenty of scope for action in more distant waters as, for instance, occurred in the case of the sinking of the *Bismarck*.

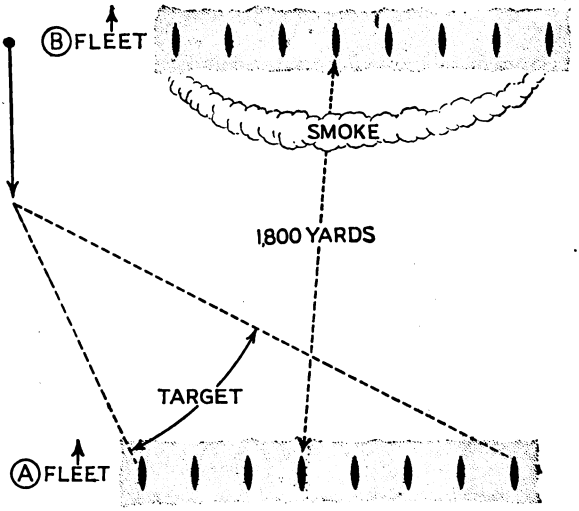

Fig. 20. *Here* B *fleet is striving to break off action and has put up a smoke-screen. Any damaged ship will, however, be overtaken by* A *fleet. The latter is in danger, nevertheless, from any sudden torpedo attack by destroyers coming out at high speed from behind the smoke-screen*

It has been said with truth that a country cannot be beaten unless its army has been thoroughly defeated; similarly, we shall never lose command of the oceans until our battle fleet has been fought and beaten. We should therefore concentrate on our battle fleet retaining command of the oceans, over which control is of vital importance, and leave coastal waters to defence by vessels of less intrinsic value, which are, in these times, more suited to that purpose.

CAUTION TO NOVICES

One word of caution to the novice who may deal with naval tactics. It has often been suggested that, now that steam has endowed a fleet with an almost infinite elasticity of movement, it should be possible to split up a fleet either during or before an action, so as to carry out enveloping movements. This is not the case. We have only to consider the great ranges (from fifteen to twenty-five thousand yards) at which modern naval actions are fought, to appreciate that the distances involved are far too great to allow of any such attempts.

An enveloping movement would necessitate the steaming of one portion of the fleet for a distance of some fifty or sixty miles, during which time a simple movement on the part of the enemy might result in the engagement and annihilation of a portion of the fleet. Only when both portions of the fleet so used are equal to the enemy in strength could such eccentric movements be safely employed. Moreover, any such attempts must be observed in their early stages by the enemy when steps are certain to be taken by him to defeat them.

Having dealt with actions in which both fleets wish to fight, we will turn to those in which one side wishes to evade encounter. The Battle of Jutland afforded a first-class example of two fleets meeting, one of which was dead keen to engage, while the other was disagreeably

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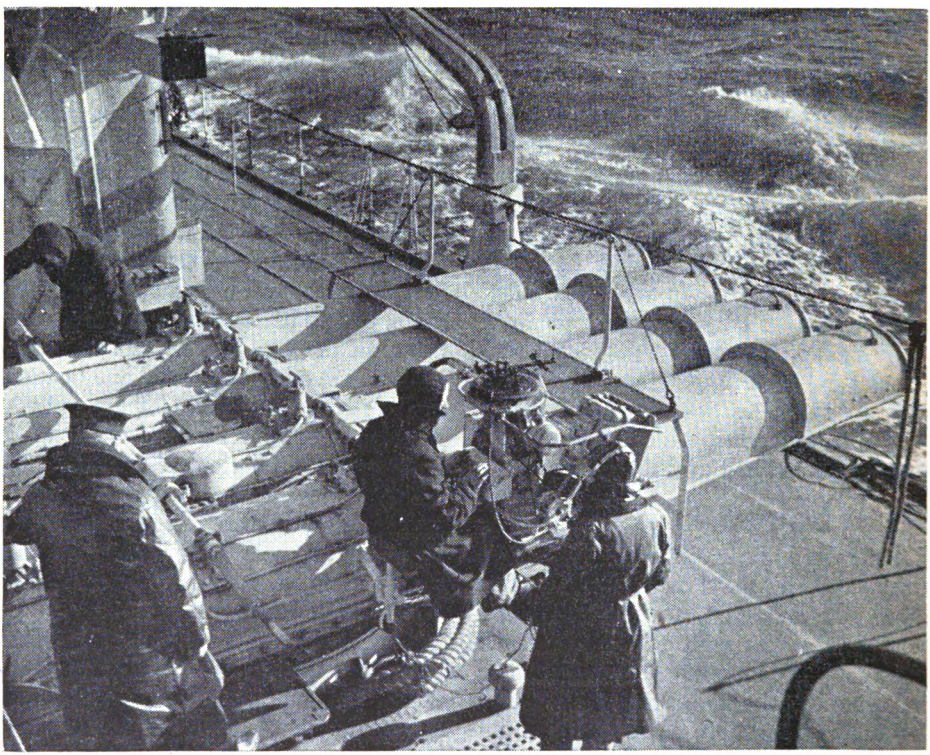
surprised and wished for nothing better than to regain the safety of its harbours. That a close action did not take place at Jutland was primarily due to the fact that the German High Sea Fleet had been chasing our Fifth Battle squadron (under the impression that it was the only battleship unit that we had at sea) and in doing so became strung out.

STRUNG OUT SHIPS

The leading ship of No. 1 squadron was two miles ahead of No. 2 and five miles ahead of No. 3 squadron. The Grand Fleet could only steam at twenty knots. The result was that the 22-knot German division could steam away right out of sight of our ships; the 20-knot division being already two miles beyond the vision of our ships could keep out of sight; and it would have taken $2\frac{1}{2}$ hours of steaming before the 18-knot division could have been sighted. In fact, the leading fast ships acted as scouts to the rest of the fleet. It will, therefore, be seen that such a disposition may well stave off an action unless the initial contact is made early in the day.

The chase most commonly visualized is that, when towards the close of an action, the worsted side turns away more or less in line abreast and makes for its harbours. Such a case is shown in Fig. 20. The main points in such a position are :

1. Any damaged ships in B fleet which cannot steam as fast as the fastest ship in A fleet will be very soon overtaken



MANNING THE TORPEDO TUBES ON A DESTROYER

These torpedo tubes are trained on the beam and ready for action. The man at the director will fire all four torpedoes simultaneously as soon as his sights come in line with the enemy's ship

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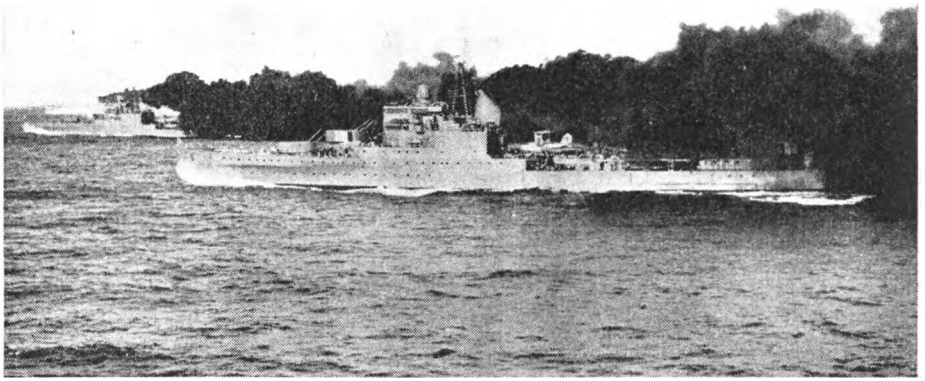

CRUISERS PUTTING OUT A SMOKE SCREEN

These cruisers are of the Southampton class. Their displacement is 9,000 tons; they have a main armament of twelve 6-in. guns and carry three aircraft. Smoke screens are very useful to a fleet in retreat, as in Fig. 20. They interfere with the ranging of the enemies' guns

and immediately brought into action.

2. The smoke from the funnels and any screen made artificially will obscure B fleet and make good shooting on the part of A fleet very difficult, even with the aid of spotting aircraft.

3. The position of A fleet is a dangerous one from the point of view of attack by B's destroyers. For, steaming at forty knots down the smoke, while A is approaching them at thirty knots, they will in under seven minutes be in a position to fire their torpedoes.

NIGHT ACTIONS

The admiral commanding the stronger and better practised fleet will never willingly engage in a night action if it is possible for him to avoid doing so. The reason for this is that any night action is a pure gamble. The battle range is reduced to some 3,000 yards, a point-blank range, so all gunnery efficiency and refinements are thrown to the winds, and chance and the torpedo brought into play. Notice may have been received that the enemy's ships are in the vicinity and their course and disposition reported. Measures can then be taken to attack under conditions more or less of equality. But, as may well be the case, and was the case on the night after Jutland, the enemy steering blindly and madly for one of several objectives does not, as at Jutland, just miss your fleet, but smashes straight into it—and your position as admiral is by no means an enviable one.

Of course, if the enemy will escape unless fought at night, then fight you must; but it is far better if possible to wait until daylight before joining action.

Destroyer attack is bound to complicate a night action and be an aid to the less practised fleet; since all close-quarter fighting favours the more inefficient side, by depriving his adversary of the advantage of the skill that long practice and discipline have created in the vessels which are under his command.

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BRITISH WARSHIPS STEAMING NEAR GIBRALTAR

The famous Rock is one of the most important British naval bases. It affords accommodation for the ships guarding the western approaches of the vital Mediterranean sea route

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CHAPTER 15

Fleets and Naval Bases

Organization of naval forces. Dispositions. Shifting circumstances of war. Function of a fleet. A watching blockade. Inactivity in harbour. Chief function of a naval base. Equipment of bases. Density of shipping. Uses of Gibraltar. Home bases. French Mediterranean fleet. Dispersal of forces. Storm centre of the world.

In time of war, it is not possible to give a clear and accurate definition of the composition and whereabouts of the various fleets and squadrons in which the Navy as a whole is organized, such as used to be included in time of peace in the Navy List which anybody could buy at a stationer's shop.

In the first place, it is not permissible to inform the public—and therefore the enemy, who closely watches the Press of the world for the chance revelation of details that may be of use to him in his operations—of the whereabouts of H.M. ships, the squadrons in which they are organized, and the bases which any of those squadrons are using. That information might well enable the enemy to forecast the nature of operations in contemplation by the Admiralty, or the theatre in which they were to be expected; also, when planning his own operations, it would give him knowledge of where his principal opponents were, so that he could plan either to attack or to evade.

In the second place, the organization and disposition of naval forces change from time to time with the changing strategical situation, and a description of what they are today may well be quite out of date a week hence. It is the peculiar characteristic of ships and fleets that they are not tied down to this station or that. Provided there is a base at which they can replenish with fuel, provisions and stores, and can be provided with assistance in such repairs as are beyond the capacity of the ships' own companies, a squadron can be moved half across the world and can begin operations on its new station with no more delay than it takes to make the passage.

For instance, on April 13, 1940, H.M.S. *Warspite* was in action against German destroyers in Ofot Fjord, out of which Narvik harbour opens—within the Arctic Circle. In less than two months she was flying the flag of Admiral Sir Andrew Cunningham in the Mediterranean; a fortnight later she was in action against the retreating Italian battleships in what was later known as the Battle of Calabria.

ZONE OF OPERATIONS

The destroyer H.M.S. *Kimberley* was also heard of in action successively within six months in Narvik and in the Southern Red Sea, accounting for a German destroyer in the first encounter and an Italian in the second. Of the three ships which gained the victory in the Battle of the River Plate on December 13, 1939, two arrived at Plymouth and the third at Auckland, New Zealand, two months later almost to a day; while the commodore—rear-admiral as he had then become—remained in command of his station with his flag in another ship.

It is thus neither permissible nor useful in war to disclose the organization or whereabouts of ships and squadrons, except so far as, for the moment, they

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have become known to the enemy by actual contact. The veil is therefore lifted for a moment when an action has occurred, and official announcements describing battles commonly give the names of the ships that the enemy has seen for himself.

After the sinking of the *Bismarck*, for instance, it was revealed that she had been shadowed from north of Iceland to mid-Atlantic by the cruisers H.M.S. *Norfolk* and *Suffolk*; that she was first engaged by H.M.S. *Hood* and *Prince of Wales*; then attacked by the aircraft of H.M.S. *Victorious*; searched for by H.M.S. *Renown* and *Sheffield*; attacked and damaged by torpedoes from the aircraft of H.M.S. *Ark Royal* and from the destroyer flotilla comprising H.M.S. *Cossack*, *Zulu*, *Maori*, *Sikh* and *Piorun*; disabled by the gunfire of H.M.S. *King George V* and *Rodney*, and finally sunk by torpedoes from the cruiser H.M.S. *Dorsetshire*. The enemy had observed all these ships for himself, and is known to have been in constant radio communication with Germany, since the message sent by Admiral Lutgens to the German High Command before the last engagement began was published and broadcast.

THE STRATEGIC SITUATION

So there was no object in concealing the names of the ships engaged from the British public, once the action was over; but nothing is published of the stations to which those ships then return, or of any changes in organization and disposition that may be made in view of the alterations of the strategic situation which may result from the outcome of the action.

Similarly, after the Battle of Cape Matapan, the world was informed that the commander-in-chief of the Mediterranean Fleet, Admiral Sir Andrew Cunningham, flew his flag in H.M.S. *Warspite* and had with him the battleships H.M.S. *Valiant* and *Barham*; that his aircraft carrier was H.M.S. *Formidable*; and that Vice-Admiral Pridham-Wippell flew his flag in H.M.S. *Orion* and had with him the cruisers H.M.S. *Gloucester*, *Ajax* and *Perth*, as well as a number of destroyers. But nothing was published to indicate what other ships were comprised in the Mediterranean Fleet, either then or later.

EFFECTIVE STRENGTH

There was no damage or casualties to any British ship in the battle, so that all those engaged in it were just as fit for further action after it as before, and no need arose, as sometimes does after a battle, for any of them to be replaced by others. But the reduction in the effective strength of the enemy fleet as the result of the action might well have made it possible for some ships of it to be detached to strengthen another fleet on which the calls might have been, for the moment, more urgent; and if so, it would be important that the enemy should not know that such a change had been made.

These examples serve to illustrate the frequency with which both the composition and the stations of the various fleets in which the Navy is organized are changed in the shifting circumstances of war. There is indeed nothing fixed or definite about them. They depend upon the strength and situation of the enemy's naval forces, and they are changed, and moved about, as necessary to secure the constant command of the sea, and the protection of British sea communications in various parts of the oceans, as one or other may be threatened or need special attention. The one governing condition, already mentioned, is that every fleet or smaller naval force needs a base or bases from which to work.

A fleet, of course, is only fulfilling the function for which it was built when it is at sea, and that fleet is the strongest which is capable of keeping the sea longest. In this connexion, it may be recalled that some British cruisers were at sea during

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the early months of the Second World War for 100 out of 108 days. For the function of the fleet is to command the sea, and so ensure the full use of the seas by our own traffic whilst denying them to that of the enemy. There is only one certain method of achieving that end, and that is to engage and destroy any enemy that may attack our traffic. And that can be done—by navies, at least—only at sea.

In some circumstances it may be possible for a fleet which is playing its part in the exercise of command of the sea, to spend a good part of its time in harbour, should the enemy's situation and the strategy he adopts make it possible to maintain a "watching blockade" in that manner. In the war of 1914-18, for instance, the function of the British Grand Fleet was to engage the German main fleet should it emerge from the shelter of its defended and inaccessible bases. It was able, owing to the conformation of the North Sea, to hold itself in constant readiness to perform that function while still spending much of its time in harbour at its base, Scapa Flow in the Orkneys.

DISPERSED FORCES

In so doing, it was playing a passive rather than an active part in the exercise of command of the sea. By interposing itself between the German concentration of naval force and our own dispersed forces, which were escorting convoys in home waters or patrolling trade routes in more distant seas, it made it possible for those weak forces to perform their functions of protecting British shipping against the small dispersed forces of the enemy—U-boats, the surface raiders—without risk of being overwhelmed by superior force. But it was the latter, the destroyers and sloops, the cruisers and armed merchant cruisers in the farther seas, which were exercising command of the sea.

They were at sea without intermission, beyond the minimum needs to keep them in sea-going condition; and the Grand Fleet itself, though it was able to avoid the material wear and tear of constant cruising, hardly ever spent as much as a fortnight in harbour without going out for a sweep, or an exercise cruise, in the North Sea, whereby the moral wear and tear of continuous inactivity in harbour could alone be successfully avoided.

DISINTEGRATED

The disastrous effect of such inactivity was never more clearly illustrated than in the case of the German Fleet, in which the German collapse started, for it was not a beaten force, though it had not gained a victory in its only battle; it had simply disintegrated through lack of activity. Thus, in all cases, the true chief function of a naval base is not to shelter a fleet, but to keep it at all times ready for sea.

For that purpose, a base needs certain equipment, depending on the size and importance of the fleet which will have to work from it, and on the scale of enemy attack to which it may be subject. Bases vary, from a mere anchorage in which men-of-war may meet supply ships carrying the fuel, stores and provisions they need to enable them to keep the sea—as Port Stanley in the Falkland Islands was used by Admiral Sturdee's squadron in December, 1914—to a fully defended port, containing a first-class dockyard capable of the largest and most elaborate repairs to damaged ships, such as replacement of heavy guns or reblading of stripped turbines and stocks of every sort of store that a man-of-war may need. An important part of the pre-war provision of naval defence, therefore, is the equipment of bases in the areas in which fleets will be required to operate.

What those areas are is determined by two factors—the distribution of British sea communications throughout the world, and the identity and position of the enemy fleets. The former are shown on

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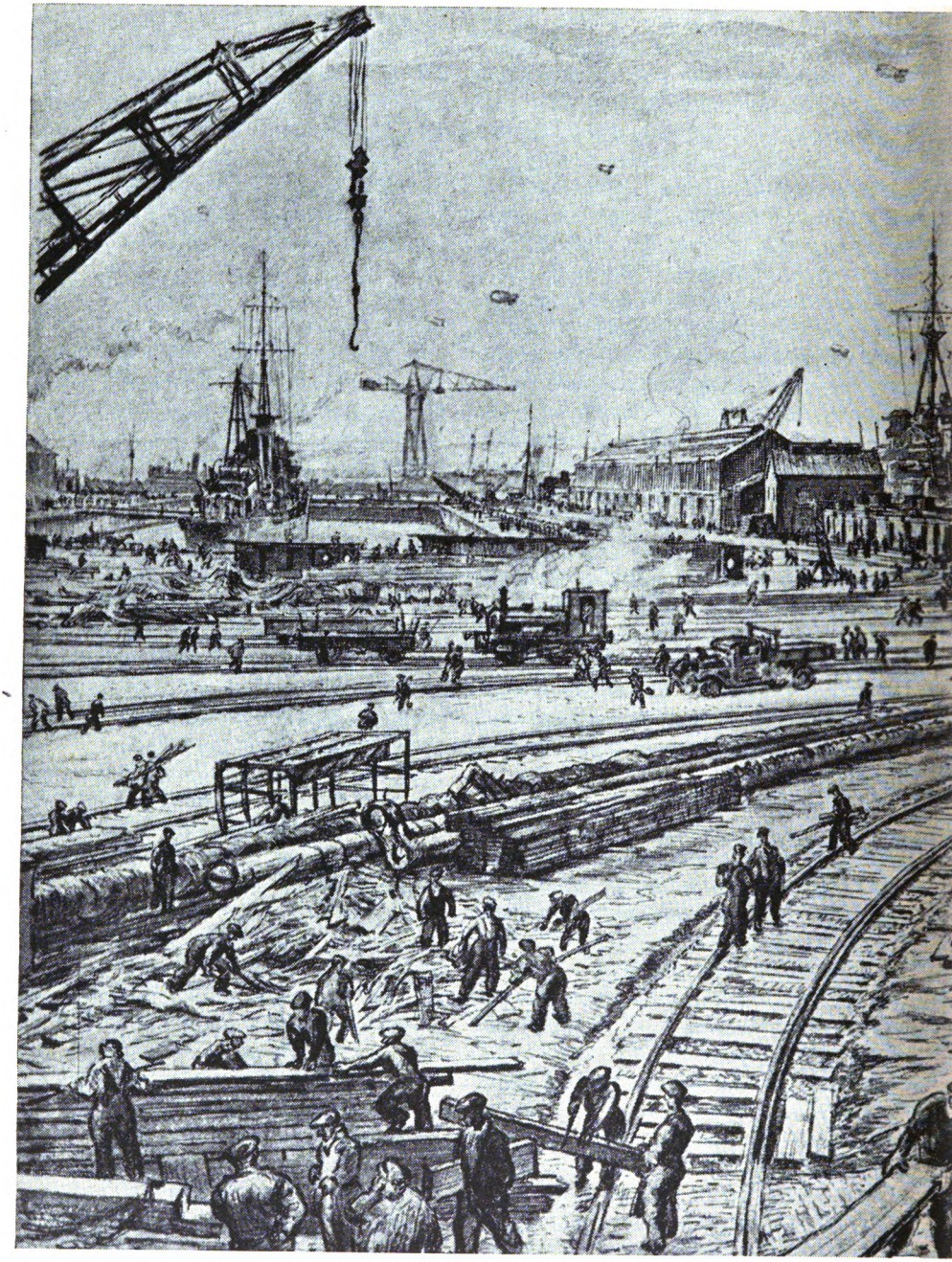

DRAWING OF ROSYTH DOCKYARD BY SIR MUIRHEAD

Dockyards are essential to a fleet and Rosyth Dockyard is one of the most important of the British yards. The drawing shows the extent of such a dockyard and stresses the activities that

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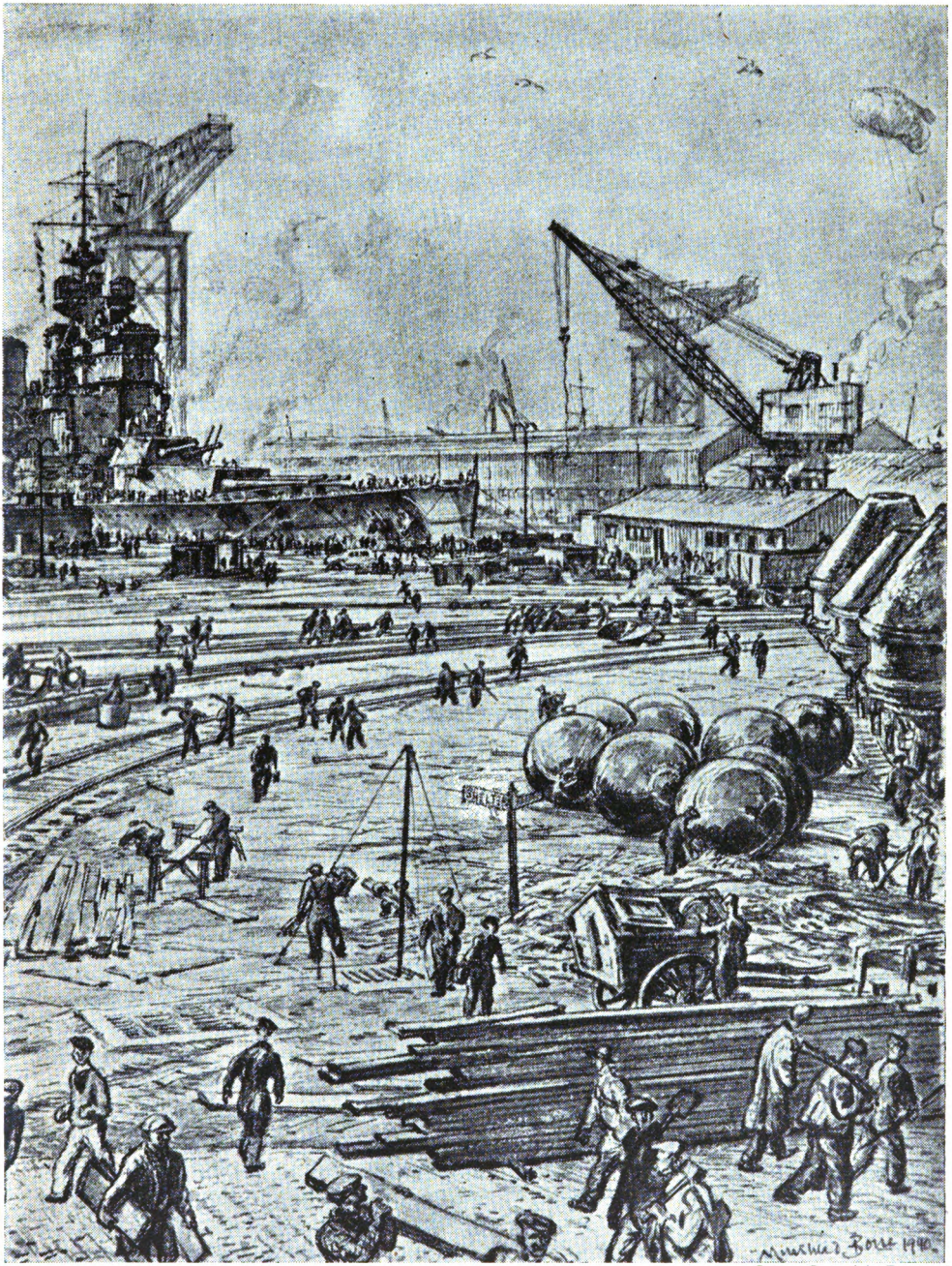

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BONE, THE OFFICIAL ADMIRALTY ARTIST

all contribute to the building of warships. In dock are seen (on the right) H.M.S. King George V and (on the left) the well-known destroyer H.M.S. Cossack, each being refitted

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most charts of British trade routes, together with the density of shipping on them. The density of shipping is, of course, greatest in the approaches to the British Isles, and it thins out from that centre to the opposite ends of the earth. But there is very little thinning on two of the routes for some 3,000 miles—that across the North Atlantic to Canada and the U.S.A., and that through the Mediterranean and Red Sea to the East. Second to those two only in importance are the routes to the South Atlantic, to South America and South Africa.

Whatever the enemy, then, these areas will need protection on the highest scale of any that is provided; and it is for this reason that two of the principal British fleets have always been those stationed at home and in the Mediterranean Sea. There, naval bases of the first class are needed, and it is to that need that we owe the possession and development of Gibraltar and Malta. These are supplemented, at the confined part of the route to the East, by Aden, so placed that it can serve a force which controls the southern entrance to the Red Sea.

GIBRALTAR'S EARLY DAYS

For nearly two centuries after it passed into British possession, Gibraltar was of little real assistance to the Navy. It was a fortress of great strength, and ships could lie under the protection of its guns; but it had no fully protected harbour, no repair resources, and not much storage space for the supplies needed by a fleet. Only when Spain was a neutral could it even be used as a source of fresh provisions. Moreover, in the days of sailing ships communication between it and the Mediterranean proper was often severely restricted by persistent winds making passage one way impossible for weeks at a time; so that there is no great call, from the point of view of the needs of fleets in the Mediterranean, for its resources to be improved.

The coming of steam, however, abolished the difficulties of communication, and it became a position of great value, not only for the inside of the Mediterranean but also for those squadrons which were required to operate outside the straits in the important area of the Atlantic through which the approaches to the Mediterranean run. An enclosed harbour was then constructed at great cost, and a dockyard built, the resources of which were further enlarged just before the outbreak of the Second World War.

EXAMINATION ANCHORAGE

Gibraltar has been used a great deal in this war. Before the collapse of France it was used as an examination anchorage for the enforcement of the blockade in respect of ships entering and leaving the Mediterranean. When Italy became an open enemy it was made the base of Admiral Sir James Somerville's squadron which operated in the western basin of the Mediterranean. It has the disadvantage that all comings and goings of ships in its anchorage can be observed from the Spanish shore of the Bay, where the enemy, no doubt, is able to station his agents as long as Spain is a neutral—or a non-belligerent. It has the further disadvantage that should an enemy succeed in establishing himself on the neighbouring Spanish mainland, the harbour and anchorage could be made untenable by artillery fire and by the use of aerial bombing; the fortress itself is probably as impregnable as ever, but it would become useless as a naval base.

Malta is yet another formidable British fortress, as war against an enemy whose airfields are no more than sixty miles away has shown. It, too, has a fully equipped dockyard, capable of major repairs to men-of-war. But it is too small to make possible the provision of air defences on a scale commensurate with the intensity of air attack that can be

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brought against it, so that it has become unsuitable as the chief operational base of a British fleet in the Mediterranean. It therefore became necessary for the fleet to provide itself with an alternative in the Eastern Mediterranean, which is out of range of a force based on Gibraltar; that has been done, at Alexandria.

The bases at home, together with those described in the Mediterranean area, suffice to provide for the fleets necessary to give protection against European enemies to the supply routes where traffic is densest; and since those fleets must be needed in any war in which we may be involved, their maintenance has been ensured by basing on them the two principal fleets in which the Navy has been organized in time of peace. From 1921 to the end of 1936 we were restricted by treaty to fifteen capital ships, of which at any one time from two to four were out of commission, or under repair or reconstruction.

The remaining twelve or so were kept in full commission, organized in two main bodies, the Home Fleet and the Mediterranean Fleet, each of which was completed by a suitable complement of cruisers and destroyers. The composition of these fleets varied from time to time in that period, but there were divided between the two stations, as a general rule, two battle squadrons and a squadron of battle cruisers, three cruiser squadrons and six flotillas of destroyers.

TACTICAL DISTRIBUTION

This was the state of affairs at the outbreak of war—leaving out of account for the moment the fleets and squadrons in farther seas—and it was a very suitable distribution to deal with the naval situation that was then disclosed. In northern waters was the German Fleet, which then consisted of two battle cruisers (a term which has not been in use in foreign navies; they are known to the Germans as battleships) — the *Scharnhorst* and *Gneisenau*; three small battleships, the *Deutschland*—since renamed *Lutzow*—the *Admiral Graf Spee* and *Admiral Scheer*; two big cruisers armed with 8-in. guns; seven 6-in. gun cruisers; some sixteen destroyers and seventy submarines.

THE ITALIAN FLEET

There were also the two new big battleships, *Bismarck* and *Tirpitz*, nearing completion, together with a number of cruisers. In the Mediterranean was the Italian Fleet—which might at any moment become an enemy, though the position was uncertain at the outset. Against this possibility provision had to be made. It was, for the moment, practically (but not wholly) balanced by the French Mediterranean Fleet; and in any case it had been agreed between the Allies that the British admiral should be in command in the Eastern Mediterranean, so that a substantial part of the Allied Fleet in that sea, in the event of hostilities against Italy, would have to be supplied by the British Navy. The Mediterranean situation will be dealt with separately.

In home waters there was obviously no need for a great concentration of force, such as the Grand Fleet of the war of 1914-18. It was not necessary to maintain the Home Fleet as a force greater than that sufficient to deal with the small German Fleet should it emerge and operate as a concentrated force—as it did on December 13, 1939, when it was observed and attacked by H.M. Submarine *Salmon*. The composition of the Home Fleet was, of course, not made public and it was no doubt varied from time to time as circumstances and the needs of other areas dictated. But it certainly comprised H.M.S. *Nelson*, *Rodney* and *Barham* at one time or another. Those names became known through damage to the ships having been announced after it had been made good, H.M.S. *Nelson* by a

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THE MAIN BRITISH TRADE ROUTES AND

The map shows the position of every British steamship using these routes at a given time and day just before the outbreak of the Second World War. Malta, Alexandria and Aden are the main British bases in the Eastern Mediterranean and Red Sea. Capetown, Durban,

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NAVAL BASES IN EASTERN WATERS

Mombasa and Mauritius protect the routes between Capetown and India. Ceylon protects the coastline of India. Further east, the British strategic bases were Hong Kong and Singapore. Darwin and Fremantle are British anchorages covering the western coast of Australia

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magnetic mine in December, 1939, H.M.S. *Barham* by a torpedo from a submarine in the same month, and H.M.S. *Rodney* by a bomb off Norway in 1940.

There are, however, other needs to be provided for besides the contingency of a German concentration; they arise from the danger of an enemy dispersal of his forces, making use of evasion to carry out sporadic attacks on British sea traffic.

The U-boat campaign is not mentioned in this connexion though it is, in truth, a part of the strategy of evasion and dispersal. The defence against it is provided by means of the convoy system. The distribution of the British surface fleets, with which we are here concerned, is designed to make the anti-submarine escorts efficacious by ensuring that they are not interfered with by any superior enemy force of more powerful surface ships. But the enemy, besides using all his ships concentrated, as he did on December 13, 1939, also employed them separately, passing them out singly into the oceans by evasion to prey on British merchant shipping beyond the reach of the Home Fleet—not an especially difficult task in the long winter nights.

IN THE OUTER SEAS

One German battleship, indeed, the *Admiral Graf Spee*, was already out in the Atlantic before the outbreak of war. To provide against this possibility British squadrons have also to be maintained in the outer seas, of a strength capable of dealing with such attacks as are likely to be encountered there.

The location of such foreign squadrons can also be deduced from a study of the distribution of British shipping and the countries of the British Empire, for it is not only the supplies to these islands that have to be protected but also the inter-Imperial communications. Each of the foreign stations must have a naval base as the headquarters of the squadron allocated to it, and these were selected, established and fully equipped as part of the widespread organization of Imperial defence in time of peace.

The relative scale and importance of these bases was also determined, not only by the volume of communications to be defended but also by the scale of possible attack to which it might be subject in war.

AFRICA STATION BASE

Taking them in order of position, the base of the Africa station is Simonstown, where there is a naval dockyard, belonging to the Admiralty though it stands on land belonging to the Union of South Africa, which also has undertaken to be responsible for its defence. The African squadron before the war consisted of only two cruisers and four sloops, but it has been greatly strengthened during the war. In December, 1939, it is known that H.M.S. *Renown* and *Ark Royal* called at Simonstown during the search for the *Admiral Graf Spee*, though it does not follow, of course, that they were definitely attached to that station.

Two months earlier, H.M.S. *Ark Royal* had been in the Home Fleet, at the time that she was first alleged by Dr. Goebbels to have been sunk by German bombs. Three months later, H.M.S. *Renown* was again in the Home Fleet, when she engaged the *Scharnhorst* and a German cruiser in the Arctic Circle not far from Narvik. It was the facilities provided by the existence of a fully equipped British naval base at Simonstown that enabled the two ships to reinforce the African squadron in the search for the German raider in the South Atlantic.

Before leaving the South Atlantic, it may be noted that another area of it, comprising the trade route from this country to the River Plate and South America generally—an area of enormous importance to the sea-borne supplies of this country—possesses no adequately

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equipped naval base. The British squadrons operating in those waters in war have had to improvise their base in the only British possession there, the Falkland Islands. Port Stanley in those islands was used by Admiral Sturdee in 1914 when he engaged the German squadron under Admiral Graf Spee and sank four out of five ships composing it. It was also used twenty-five years later by the squadron under Commodore Harwood when with his three cruisers (the fourth, and most powerful of them all, at the time of the battle was under overhaul in that same anchorage) he engaged the German battleship *Admiral Graf Spee* in the action which resulted in her final and complete destruction.

Farther to the east, in the Indian Ocean, the bases at Colombo and Trincomalee provided for the cruiser squadrons which are necessary to deal with raiders that may reach those seas. The repair facilities of Bombay and Calcutta were also made available to those squadrons, while Aden provides a secondary base of great importance for forces controlling access to and exit from the Red Sea.

A TOKEN SQUADRON

Some forty years ago, the British China Fleet—then based on Hong Kong, the chief British dockyard in the Far East—was the strongest fleet outside home waters. For the Far East then seemed to be the storm centre of the world where British interests were most likely to need defence. Just before the Second World War it had dwindled to a mere token squadron, partly because in the weakened condition of the Navy its ships were needed more urgently elsewhere and partly because the volume of British trade with the Far East had greatly dwindled in the economic chaos that reigned there at that time.

It remains now to deal with the Mediterranean Fleet, the equivalent, in time of peace, of the Home Fleet as one of the main concentrations of British naval strength. Once it became clear in 1939 that Italy was not to be immediately belligerent, it seems that the Mediterranean Fleet was much reduced; the ships that composed it were employed where they were badly needed elsewhere—the flagship H.M.S. *Warspite*, for instance, was employed in the Arctic Circle in April, 1940. But as soon as the threatening attitude of Italy indicated an intention to abandon non-belligerency for belligerency, it had to be reconstituted once more, with the greatest possible speed

IMPRACTICABLE

The configuration of the Mediterranean makes it impracticable, in these days of large air forces, for an enemy of Italy to base a considerable fleet in the central Mediterranean. It might, however, have been done while France was still our ally if the airfields of Tunisia had been fully developed. It was necessary therefore to maintain two separate forces at the ends of the sea. The fleet in the eastern basin, under the command of Admiral Sir Andrew Cunningham, was chiefly British but contained a French contingent. The western basin was left entirely to the control of the French Fleet.

The collapse of France upset these arrangements, and they had to be modified to enable British fleets to undertake both tasks. This they have done, despite their diminished strength, with complete success. Sir Andrew Cunningham's successes in the attack on Taranto when half the Italian battle fleet was crippled for months, and in the Battle of Cape Matapan when half the Italian heavy cruisers were destroyed, were ably matched by Sir James Somerville's intrepid attacks on Italian bases. His repeated efforts to engage more powerful Italian fleets have, however, always been frustrated by the elusive enemy.

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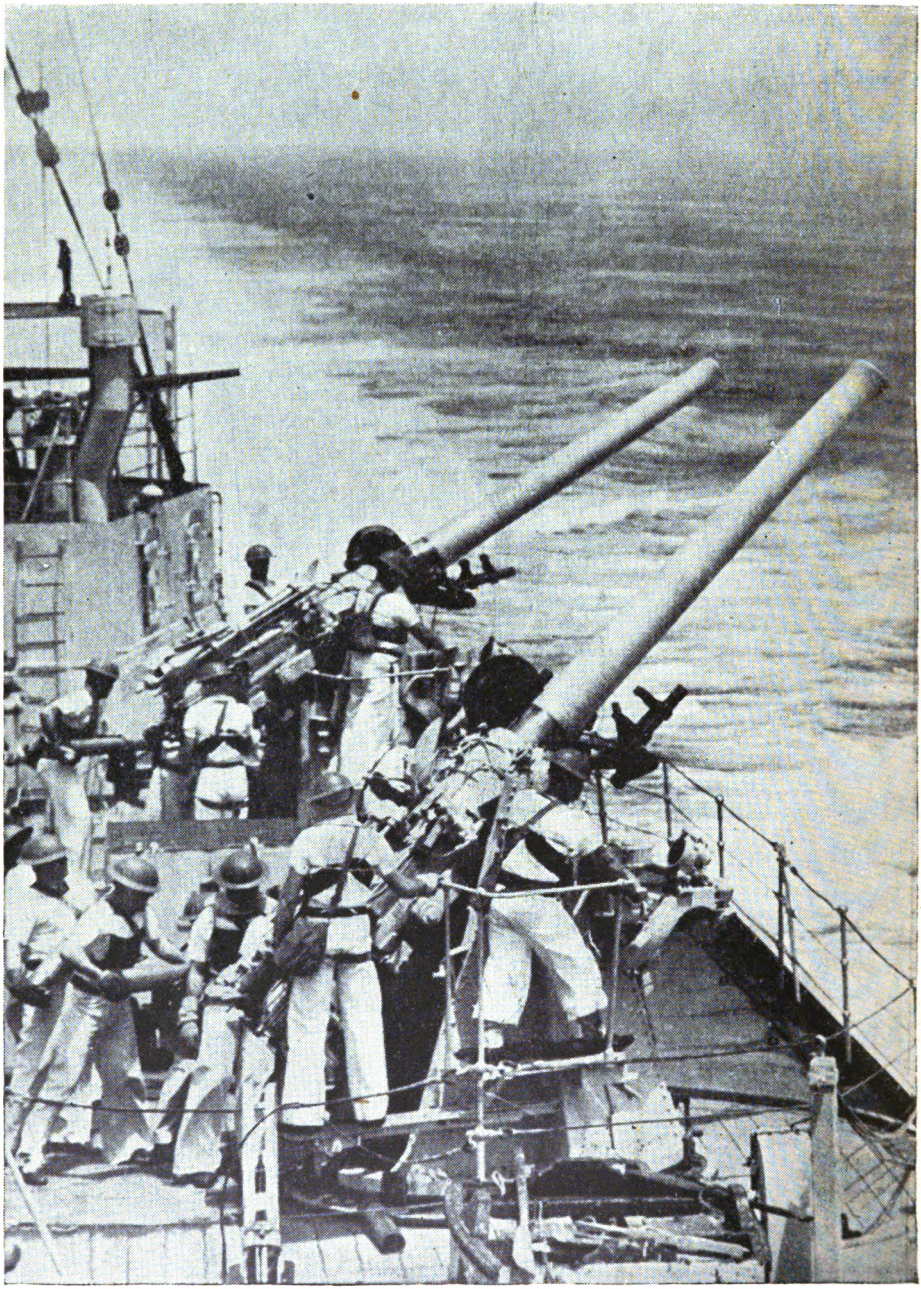

GUNNERY PRACTICE IN THE ROYAL AUSTRALIAN NAVY

Efficiency in action is achieved only after arduous practice beforehand. These Australians are working hard at their guns in order to be effective when the time for action arrives

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CHAPTER 16

Navies of the Empire

East India Company's naval force. Bombay Marine. Teak ships. Indian Marine. Royal Indian Navy. Royal Australian Navy. Royal New Zealand Navy. Royal Canadian Navy. South Africa's naval forces. Newfoundland Royal Naval Reserve. Value of volunteers

NAVAL forces are maintained by a number of our overseas dominions and dependencies, as well as by the Government of India. Of these the oldest is the Royal Indian Navy, the origin of which dates back to the earliest days of British rule in India. For this reason it is convenient to deal with it first.

Actually the foundation of the R.I.N. ante-dates that of the Indian Army. In 1612 a naval force was organized by the East India Company's agent at Surat to afford protection against the aggressions of the Portuguese and of pirates. At that time the Company had not a single soldier, European or sepoy on its pay-roll. This naval force was composed of a number of grabs and gallivats—vessels of local type, both of which carried sails, though the latter depended more upon oars for propulsion. They were armed with from two to six guns, according to their size, and were manned by volunteers from the Company's trading ships. They operated mainly on the Malabar coast and in the Gulf of Cambay.

The first important action of this embryo navy took place in January, 1615, when a Portuguese squadron of considerable strength attacked Surat and was defeated with the loss of 350 men. In the siege and reduction of the Portuguese stronghold at Ormuz, in the Persian Gulf, in 1622, the Surat Marine (as it later came to be called) played the leading part. Various other actions against the Portuguese and the Dutch followed. But after 1668, when Bombay was transferred to the Company from the Crown, the importance of Surat declined, and in 1686 Bombay was made the seat of government in its stead, and the Company's sea forces became known as the Bombay Marine.

During the late seventeenth and early eighteenth centuries, the affairs of the English in India underwent many vicissitudes; and the Marine was often called upon to resist the Company's enemies with very inadequate forces. In the year 1715 the ships of the Marine are said to have included one of seventy-four guns, two of sixty, one of fifty and eighteen considerably smaller vessels of from thirty-two to twelve guns each.

WHERE PIRATES SWARMED

At this time the Mahrattas and others frequently interfered with the trade of the ports of Bombay and Surat, and the coasts of India swarmed with pirates. With the capture of Severndrug, however, by the ships of the Bombay Marine under Commodore James, in 1755, the end of their rule was in sight. The final stroke was the reduction of the still stronger fortress of Gheria in the following year by the East Indies squadron of the Royal Navy, under Vice-Admiral Watson. With him was a strong contingent from the Bombay Marine, under Commodore

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James. In the latter operation, Clive commanded the troops that were landed to occupy the silenced forts.

Not long after the fall of Gheria, Commodore James, while cruising in B.M.S. *Revenge*, of twenty-eight guns, encountered a French ship of somewhat superior force, the *Indienne*, which he captured and brought into Bombay. He subsequently became a director and ultimately chairman of the East India Company, and died in 1783. By that time he had been made a baronet, and was Governor of Greenwich Hospital, Deputy Master of Trinity House, and a Member of Parliament.

In the various engagements between the East Indies squadron of the Royal Navy under Vice-Admiral Pocock and the French force under Admiral d'Ache, the frigates *Protector* and *Revenge*, of the Bombay Marine, took an active part. Indeed, it was B.M.S. *Revenge* which first located and reported the French fleet, keeping the enemy in sight until it was brought to action on September 10, 1759. During the siege of Pondicherry, the French headquarters in India, B.M.S. *Protector* was lost, being driven ashore in a gale in January, 1761.

ADMIRAL TO GRAND MOGUL

In 1759 the East India Company was appointed to carry out the duties of Admiral to the Grand Mogul, which office was delegated by the Company to the Commodore of the Bombay Marine, adding greatly thereby to his emoluments. In 1768 the Marine undertook a successful expedition against Hyder Ali's seaports on the Malabar coast. The force suffered a severe loss in December, 1774, when its commanding officer, Commodore John Watson, was mortally wounded during the siege of Tanna, a Mahratta stronghold. In the following year ships of the Marine were sent to the Persian Gulf, with the object of relieving Basra.

By this date Bombay had developed into an important shipbuilding and repairing centre. It could boast of a dry dock superior in size and situation to any in Europe. Until wood was superseded by iron for shipbuilding purposes, teak ships constructed at Bombay enjoyed a deservedly high reputation. Two of these ships were still surviving as hulks in this country when the Second World War began, H.M.S. *Cornwall* (ex-*Wellesley*), built as a seventy-two-gun ship in 1813, and H.M.S. *Foudroyant* (ex-*Trincomalee*), built as a forty-two-gun frigate in 1819. With the exception of H.M.S. *Victory* and *Implacable*, they are the oldest of our remaining wooden walls.

MARITIME PRETENSIONS

Ships of the Bombay Marine formed part of the squadron under Sir Edward Hughes which dealt a fatal blow to the maritime pretensions of Hyder Ali at Mangular in the latter part of 1780. During the ensuing twenty years the Marine was concerned in sundry operations against Tippoo Sahib, Hyder Ali's son and successor. In the French Revolutionary and Napoleonic Wars the Marine was frequently engaged, its first operation being the siege of Pondicherry, which fell in August, 1793. In January, 1794, five East Indiamen, with the Bombay Marine cruiser *Nautilus*, fought a smart action off Anjer, Java, with two heavily armed French privateers, both of which were forced to strike their colours.

Several of the Marine's vessels took part in the reduction of the Dutch settlements in Ceylon in 1795-96; and the frigate B.M.S. *Bombay* was jointly responsible with H.M.S. *Resistance* for the capture of Koepang, Timor, in 1797. A particularly gallant action was fought by B.M.S. *Intrepid*, a ten-gun vessel manned by forty Europeans (mostly recently joined boys from the Marine Society's training ship *Warspite*) and a

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similar number of sepoys and lascars, against a more heavily armed and manned French privateer. Though B.M.S. *Intrepid* lost her captain and had twenty-eight other casualties, she defeated the French vessel, but was unable to capture her, as she sailed faster than the Bombay ship. In 1801 the Dutch island of Ternate, in the Moluccas, surrendered to B.M.S. *Swift* and *Star* and a detachment of the Company's troops after severe fighting.

In view of its fine record of service and growing importance, new regulations were promulgated in 1798 for the supervision of the Marine. This involved giving its officers ranks corresponding with those held in the Indian Army. Thus the commodore ranked with a colonel, and captains of the larger ships with lieutenant-colonels, etc. Retiring pensions and rates of pay were also fixed.

Five ships of the Marine, under Captain Deane of B.M.S. *Malabar*, took part in the capture of Mauritius in 1810. In the conquest of Java and sundry of its dependent islands, good service was rendered by a division of eight ships of the Bombay Marine under Commodore Hayes. Punitive expeditions were also undertaken against certain local Rajahs, who had committed acts of piracy, during the ensuing years up to 1816, when all our conquests in the Eastern Archipelago were restored to the Dutch. Owing to war conditions, there had been a considerable revival of piracy on the coasts of India, which kept the Marine busy for some

TRAINING GUNNERS OF THE ROYAL INDIAN NAVY

The Royal Indian Navy, formerly the Royal Indian Marine, is the oldest of the navies of the Empire. It first came into being in 1612 as a protection for the trade of the East India Company at Surat and it ante-dates the Indian Army. Today its personnel, though small in number, is highly efficient. These ratings are having gunnery practice on board ship

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years after the conclusion of the Napoleonic Wars. In 1821, the Marine sent five of its ships to the Red Sea to bombard Mocha, as the result of a wanton attack made upon the Company's staff at that port. Various operations had also to be undertaken against the Joasmi pirates of the Persian Gulf. A prominent part was, in addition, taken by the Marine in the First Burmese War of 1824-26, with much hard fighting on the Irrawaddy.

In 1828 the Bombay Marine was reorganized and its officers given relative rank with those of the Royal Navy. Two years later it was given the official title of Indian Navy. The first steam warship to be built for the Indian Navy was launched on the Thames in 1836, and was soon followed by others. During the 'thirties there was a determined effort on the part of the Indian Government to convert (for reasons of economy) the greater part of its navy into a packet service, for maintaining the service between Bombay and Suez. In 1838 a flotilla was established on the Indus, officered and manned by the Indian Navy; and in the following year the service was engaged in the operations which led to the occupation of Aden.

BOMBAY GUNNERY SCHOOL

An active part was later taken by the Indian Navy in the China War of 1840-42, including the capture of Amoy and Ningpo. It was also a prominent factor in the conquest of Sind, in 1843. During the 'forties, officers of the Indian Navy were selected for courses in gunnery in H.M.S. *Excellent*, and a local gunnery school was established at Bombay. A ship of the Indian Navy, the *Elphinstone*, was engaged in the New Zealand War of 1845-46. Six ships, all steam vessels, took part in the Second Burmese War of 1852-53. Nine others were engaged in the war against Persia, including the taking of Bushire, in 1856-57. During the Mutiny, 1857-58, numerous detachments of the Indian Navy served ashore with distinction. Eight ships were sent to China during the war of 1860-61.

In spite of this fine record of service, one of the first steps taken by the British Government, on taking over entire responsibility for Indian affairs in 1862, was to abolish the Indian Navy as a combatant force. Its officers were given the alternative of retiring on pension, or of volunteering for duty in the Bombay Marine or Bengal Marine. These Services were formed out of the remnants of the Indian Navy's ships and establishments for general transport purposes and so on.

NEW TO NAVY LIST

In 1884 these two local Services were united to form the Indian Marine. Its growing importance was recognized by the Admiralty in 1892, when a list of its officers first appeared in the Navy List. In the preceding year, officers of the Marine (which henceforth was permitted to prefix the word "Royal" to its official style) had been granted titles corresponding to those of Royal Naval Reserve officers, but they were senior to those officers in their respective ranks.

At that date the Indian Government possessed two armoured coast defence ships, completed in 1870, a dispatch vessel, a surveying ship, five troopships, a guard ship and a sailing vessel used for training, besides half a dozen river craft. In addition, seven torpedo boats had been completed and sent out from England in 1889, and two torpedo gunboats were completing. It was the acquisition of these last nine vessels which apparently inspired the decision to revise officers' titles, as mentioned, though the new ships were, in fact, manned to a great extent by the Royal Navy.

In the war of 1914-18 the R.I.M. did invaluable work in the Persian Gulf and during the advance up the Euphrates and Tigris, as well as taking part in the defence

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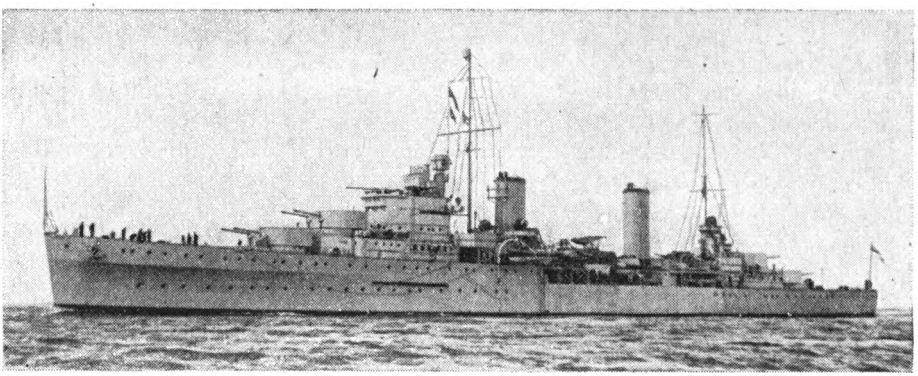
of Egypt. A number of decorations were awarded to the personnel, who had thus fully proved their right to be regarded as a combatant force. It was Admiral of the Fleet Earl Jellicoe, when he visited India in H.M.S. *New Zealand* in 1919 to advise the Government on naval defence, who recommended the reconstitution of the R.I.M. as a navy. It was not until 1925, however, that a departmental committee reported in favour of this; and the title of Royal Indian Navy was not actually conferred until 1934, when it was decreed that it should be regulated by the British Naval Discipline Act, amended to suit local conditions. When the Second World War began there were five sloops, a patrol vessel, a surveying ship and a trawler on the list of the R.I.N. New ships have since been launched or ordered, and personnel has been increased by 200 per cent. Fine work is being done by the ships of the R.I.N. in policing the Indian coasts, added to which should be mentioned the useful share taken in the landing in Iran. A newly opened training establishment at Karachi has a complement of 600, and a number of Indian officers is serving in various ships of the Royal Navy throughout the world.

Australian naval defence may be said to date from 1866, when the Government of Victoria ordered a coast defence ironclad to be built in England. By the early eighties five gunboats and three torpedo boats had been acquired, and in 1892 a third torpedo boat, of larger size, was added. New South Wales possessed two torpedo boats in the 'eighties, and Queensland five gunboats and a torpedo boat. South Australia was ambitious enough to commission a so-called cruiser; but as she was of only 920 tons, she would nowadays be counted as a sloop. This little ship served with the Royal Navy in China during the Boxer War of 1900, earning a highly complimentary report from the commander-in-chief on that station, Sir Edward Seymour. Tasmania, which owned a torpedo boat for a time, transferred her to South Australia.

At the Colonial Conference of 1887 it was agreed that a special squadron of five cruisers and two torpedo gunboats should be provided by the Admiralty "for the protection of floating trade in Australasian



H.M.A.S. SYDNEY, A FAMOUS AUSTRALIAN CRUISER

The name of Sydney has been a famous one in the Royal Australian Navy. In the war of 1914-18, it was H.M.A.S. Sydney that sank the German raider Emden. In the Second World War, the cruiser of that name sank the Italian 6-in. gun cruiser Bartolommeo Colleoni (*see page 288*). *Later, after destroying an enemy armed merchant raider, the Steiermark, she herself caught fire and went down some 300 miles west of Australia*

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waters." Towards the maintenance of this squadron the Australian and New Zealand Governments agreed to contribute jointly the sum of £126,000 per annum, of which £20,000 came from the latter Dominion. These ships served on the Australia station for many years. By 1902, Australian federation had been accomplished, and this squadron was by that time obsolescent.

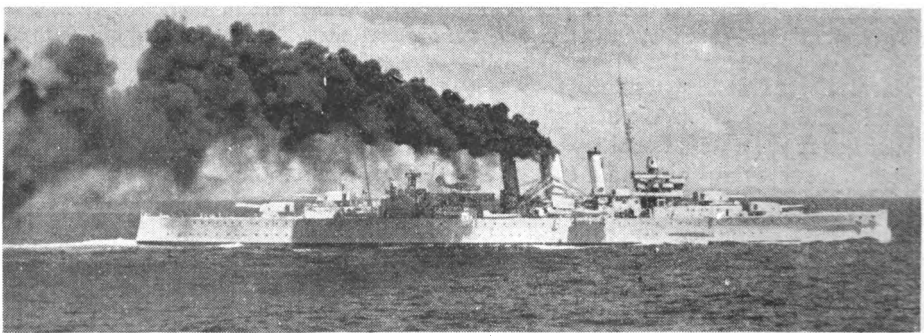
It was therefore arranged to replace it by a larger and more up-to-date squadron in return for the increased subsidy of £240,000 a year, of which New Zealand was to find £40,000. This arrangement did not last for long, as the growing tension in relations with Germany overshadowed the discussions at the Colonial Conference of 1909 to such an extent that the Commonwealth Government agreed to provide a squadron comprising a capital ship and some smaller vessels, to cost £3,700,000 in all.

These ships were the battle cruiser H.M.A.S. *Australia*, the cruisers H.M.A.S. *Sydney*, *Melbourne* and *Brisbane*, six destroyers, two submarines, a submarine depot-ship and an oiler. With the exception of H.M.A.S. *Brisbane*, three destroyers and the two auxiliaries, all were in service when war began in 1914. Together with the older ships that remained they comprised the Royal Australian Navy. This title had appeared for the first time in the Navy List for January, 1912. In August, 1914, H.M.A.S. *Australia*, *Melbourne* and *Sydney*, and three destroyers, were employed in escorting a convoy of New Zealand troops to Samoa, which was duly occupied. Thence the squadron proceeded to New Guinea, possession of which was also obtained without any resistance whatever being offered to the occupation.

HASTY DEPARTURE

While the latter operation was in progress, the German cruisers *Scharnhorst* and *Gneisenau*, which had disappeared from the China station on the outbreak of war, arrived at Samoa—to find the islands occupied by the New Zealand forces. On learning that H.M.A.S. *Australia* had been there quite recently, the two German ships hurriedly left.

On November 9, 1914, H.M.A.S. *Sydney*, while engaged in escorting a convoy across the Indian Ocean in company with other ships, was detached to the Keeling-Cocos Islands on receipt of a wireless message to the effect that a suspicious warship had appeared there.



H.M.A.S. AUSTRALIA PUTTING OUT A SMOKE-SCREEN

This Australian cruiser, together with her sister ship H.M.A.S. Canberra, is a sister ship of the British Kent class cruisers. Their displacement is 9,800 tons and they have a complement of about 700. Their main armament consists of eight 8-in. guns and they carry one aircraft They have a range of 2,300 miles at about 32 knots and of 10,400 miles at about 11-14 knots

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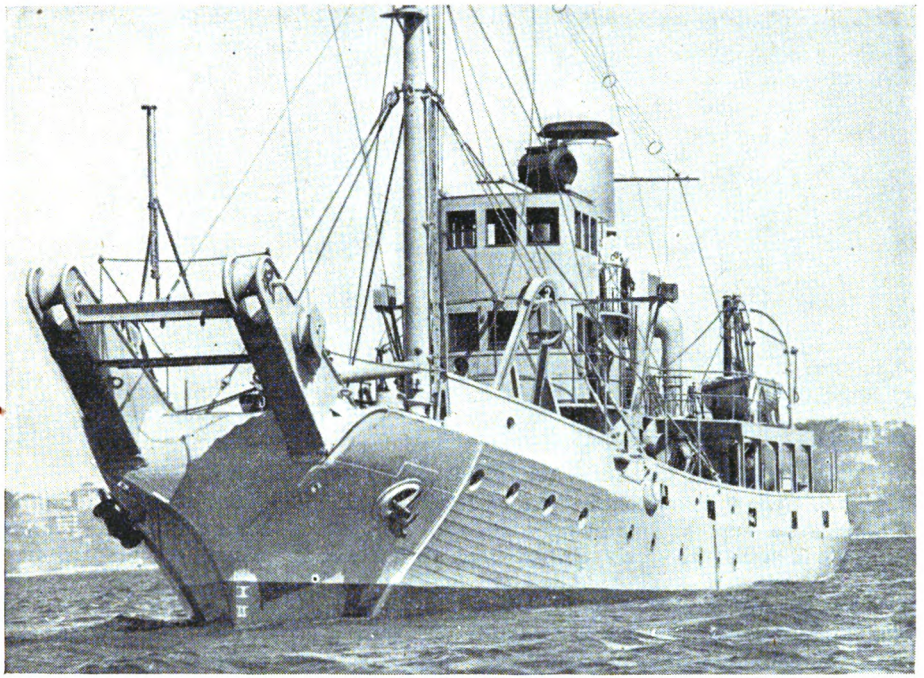

H.M.A.S. KOOKABURRA, AN AUSTRALIAN BOOM DEFENCE SHIP

The defence of harbours against submarine attack is vital. These boom defence ships are specially designed (see page 201) *to lay steel nets across harbour entrances as a protection*

This proved to be the German cruiser *Emden*, which was driven ashore in a sinking condition after a sharp action. This success was the more gratifying as H.M.A.S. *Sydney's* complement included a large proportion of young hands and ratings under training. Of all the German cruisers and armed merchant ships engaged in commerce destruction in that war, none did more damage than the *Emden* and her elimination was a decided relief, naturally enough.

HUNT IN EASTERN PACIFIC

After hunting for the *Scharnhorst* and *Gneisenau* in the Eastern Pacific, H.M.A.S. *Australia* proceeded via the Strait of Magellan to England and joined the battle cruiser force under Vice-Admiral Beatty. She arrived four days too late for the Dogger Bank engagement, and by bad luck was away at the time of the Battle of Jutland. Later in the war H.M.A.S. *Melbourne* and *Sydney* were employed in patrolling the Atlantic routes. H.M.A.S. *Pioneer*, a small cruiser, took part in the operations on the East African coast, and shelled the German defences at the mouth of the Rufiji river, where the German cruiser *Konigsberg* was sheltering. Both the Australian submarines were lost; one in 1914, the other in the Dardanelles in 1915.

Though the Royal New Zealand Navy only had that title accorded to it in the Second World War, the first New Zealand warships were acquired in 1863, for employment during the Second Maori War as armed transports. Apart from this, New Zealand's share in the arrangement by which five cruisers and two torpedo gunboats were allotted for the defence of

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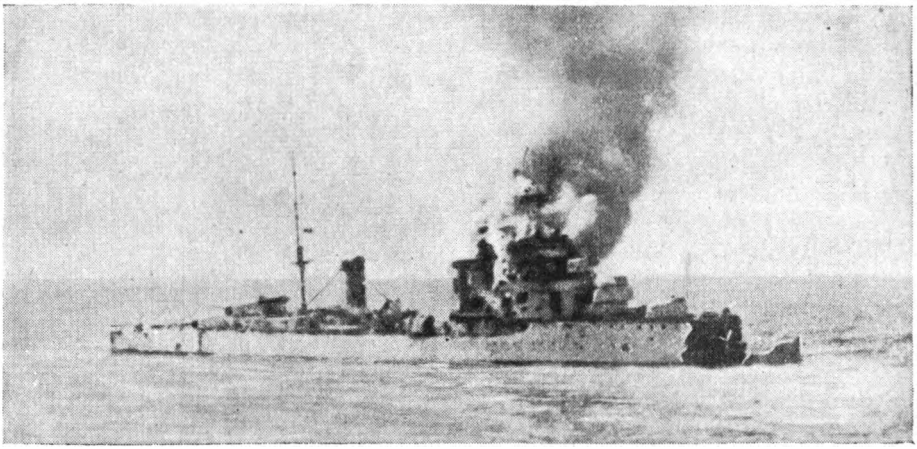

THE ITALIAN CRUISER BARTOLOMMEO COLLEONI ON FIRE

H.M.A.S. Sydney intercepted a force of Italian cruisers and destroyers in the Central Mediterranean. The 6-in. gun cruiser Bartolommeo Colleoni, shown above, was soon set on fire by the accurate fire of the British force, her bow was blown away and she later sank

Australasian trade has already been related. Her original contribution of £20,000 per annum towards naval defence was doubled in 1902, and in 1908 it was raised to £100,000.

NEW ZEALAND FIRST

After the Agadir crisis of 1909, New Zealand was the first of the dominions to offer to provide a battle cruiser to reinforce the Royal Navy's building programme. This offer was gratefully accepted. At the same time a scheme was discussed involving the constitution of an Eastern Fleet, to be formed by uniting the existing squadrons on the China, East Indies and Australia stations, and including the battle cruisers H.M.S. *Australia* and *New Zealand*, with a third such ship from the Home Fleet. This scheme did not, however, materialize owing to the necessity of concentrating all possible strength in home waters.

In 1913 a New Zealand Division of the Royal Navy was formed, comprising the small cruisers H.M.S. *Pyramus* and *Psyche* and the sloop H.M.S. *Torch*; and the small cruiser H.M.S. *Philomel*, of the same type as H.M.S. *Tauranga*, was lent for duty as a training ship for the personnel of the newly formed New Zealand naval force. She still fulfils this duty at Auckland, though launched as far back as 1890.

On completion in 1913, H.M.S. *New Zealand* made a cruise of 45,000 miles before joining the battle cruiser force in home waters. In April of that year she visited New Zealand and was the occasion of much enthusiasm. A Maori chief presented the captain with a stone *tiki* and a feather cloak to be worn in action, when, he declared, they would confer invulnerability. Both the cloak and the *tiki* were duly worn by Captain Halsey at the actions of Heligoland Bight and the Dogger Bank, and by Captain Green at the Battle of Jutland. In all these actions the ship was practically unscathed; indeed, at Jutland, when two of her consorts, H.M.S. *Queen Mary* and *Indefatigable*, were destroyed, she did not suffer a single casualty.

At the outbreak of the Second World War the Royal Australian Navy included

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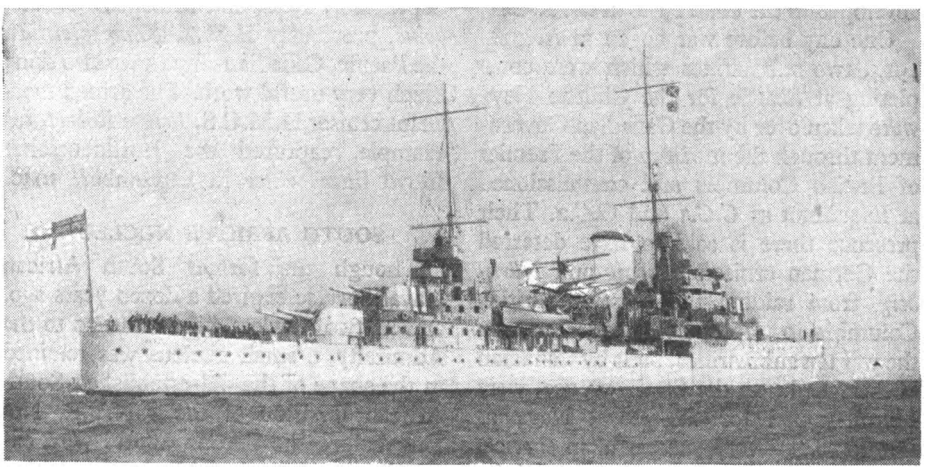
the heavy cruisers H.M.A.S. *Australia* and *Canberra*, armed with 8-in. guns; the cruisers H.M.A.S. *Perth*, *Hobart*, *Sydney* and *Adelaide*, armed with 6-in. guns; five destroyers, four sloops, a depot ship, a surveying vessel and sundry auxiliaries. At least seventeen sloops of a new type, fitted for mine sweeping, have since been built in Australian yards, as well as a dozen motor torpedo boats and many escort vessels and other small craft.

DISTINGUISHED SERVICE

In the Mediterranean, Australian warships have done valuable work. H.M.A.S. *Sydney* in particular distinguished herself on July 19, 1940, by sinking the Italian cruiser *Bartolommeo Colleoni* and by putting another enemy cruiser ignominiously to flight, though either singly should have been a match for H.M.A.S. *Sydney*. In the operations on the coast of Libya, and wherever else the Mediterranean Fleet was called upon to fight, the Australian Navy has been well to the fore. Like her predecessor in 1914, H.M.A.S. *Sydney* put an end to the career of an enemy raider in the Indian Ocean at the beginning of December, 1941, though unfortunately she herself was damaged and set on fire and, with her officers and men, was later lost in that action.

In July, 1940, the Australian destroyer H.M.A.S. *Voyager* sank an Italian submarine. On May 11, 1941, it was announced that H.M.A.S. *Canberra*, a 10,000-ton cruiser, had, together with a consort, intercepted the German supply ship *Coburg* and a captured Norwegian tanker in the Indian Ocean. The sloop H.M.A.S. *Parramatta* also distinguished herself by bringing down three enemy dive bombers.

The Royal New Zealand Navy, as it has now become, was worthily represented at the Battle of the Plate on December 13, 1939, by H.M.S. *Achilles*, one of the two cruisers lent by the Admiralty to the Dominion some years earlier. Largely manned by New Zealanders she had a great reception when she returned to Auckland on February 23, 1940. Her sister ship in the R.N.Z.N., the cruiser H.M.S. *Leander*, was responsible



H.M.S. ACHILLES, A BRITISH CRUISER LENT TO NEW ZEALAND

The British cruiser H.M.S. Achilles, lent to the New Zealand Government, distinguished herself greatly in the Battle of the River Plate. Her main armament consists of eight 6-in. guns (mounted in four turrets) and eight 21-in. torpedo tubes. Her displacement is 7,030 tons and her normal complement is 550. Her speed is 32.5 knots and one aircraft is carried

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for sinking the Italian armed raider *Ramb I* in the Indian Ocean in March, 1941, and two months later was jointly responsible with H.M.A.S. *Canberra* for the elimination of the German supply ship *Coburg*. New Zealand naval personnel has expanded considerably, and a number of mine sweeping vessels of the trawler type have been built at Auckland and in British yards.

ROYAL CANADIAN NAVY

The Royal Canadian Navy started as the Canadian Naval Service, formed in 1911 under an Act passed that year. It did not figure in the Navy List under its present name until January, 1915. In the meantime two cruisers, H.M.S. *Niobe* and *Rainbow*, had been transferred to the new force from the Royal Navy, arriving in Canadian waters towards the end of 1910. Before this the Canadian Government maintained a number of vessels for fishery protection and other duties. In the autumn of 1910 Canada took over the former Royal Naval Dockyards at Halifax and Esquimalt, which have since been developed as the main bases of the R.C.N.

One day before war began in August, 1914, two submarines which were completing at Seattle for the Chilean Navy were taken over by the Canadian Government through the medium of the Premier of British Columbia and commissioned at Esquimalt as *C.C.*1 and *C.C.*2. Their presence there is said to have deterred the German cruisers *Leipzig* and *Nürnberg* from raiding the coast of British Columbia in September, 1914. Later in the war ten submarines, built by Canadian Vickers Ltd., on the St. Lawrence, were commissioned for the Royal Navy as *H.*1 to *H.*10—very successful in service.

The Royal Canadian Navy entered the Second World War with six destroyers, five minesweepers of the trawler type and a number of Government patrol vessels, etc., which were transferred to the Navy. Since then more destroyers have been acquired and are building, while corvettes and minesweepers have been turned out from Canadian yards at an amazing rate, there now being about seventy of the former and forty of the latter. Motor patrol craft have also been built, and armed merchant cruisers and armed yachts have been placed in commission. Personnel, which in peace time amounted to 2,500, had increased to over 15,000 by October, 1940, and was expected later to reach 28,000 officers and men. In the Battle of the Atlantic the R.C.N. has participated in full measure.

In the evacuation of British subjects and refugees from Bordeaux on June 27, 1940, H.M.C.S. *Fraser*, a destroyer, was sunk by collision in the Gironde. In the following October a similar fate befell H.M.C.S. *Margaree*, formerly H.M.S. *Diana*, which the Admiralty had made over to the R.C.N. to replace H.M.C.S. *Fraser*. Other ships transferred during the war include seven of the ex-American destroyers exchanged for Atlantic bases in September, 1940, and H.M.C.S. *Assiniboine*, previously H.M.S. *Kempenfelt*. In the Pacific, Canadian ships have also done much very useful work. The armed merchant cruiser H.M.C.S. *Prince Robert*, for example, captured the Norddeutscher Lloyd liner *Weser* in September, 1940.

SOUTH AFRICA'S NUCLEUS

Though the former South African Naval Service expired a dozen years ago, and its two trawlers were returned to the Admiralty, a small nucleus was retained in the shape of the old-established South African Division of the R.N.V.R. Not long before the Second World War, expansion began again with the acquisition of two vessels of the trawler type for mine sweeping, as the nucleus of what is now known as the Seaward Defence Force. To these have since been added

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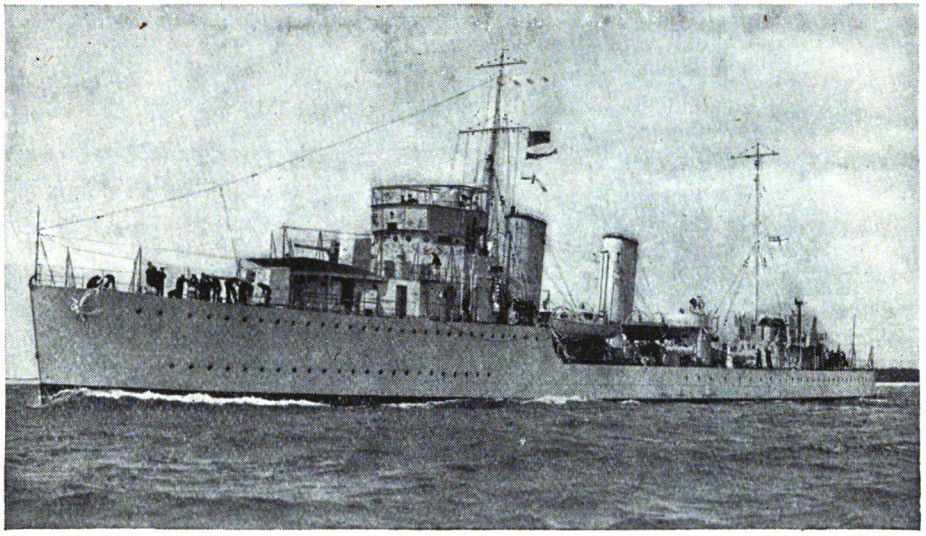
several whalers, and several motor torpedo boats have, in addition, been built. In December, 1941, it was stated that the total of South Africa's naval forces amounted to fifty-eight vessels.

Although our oldest colony, Newfoundland maintains no navy. It possessed before the Second World War, nearly a dozen ships, used for maintaining communications around the coast and suitable for use as small transports or patrol vessels. In addition, the local fishing fleet provided a body of seasoned sailors embodied in the Newfoundland Royal Naval Reserve.

In the war of 1914-18 these were used almost exclusively for the boarding parties of the Northern Patrol, and they have been equally useful more recently in the North Atlantic.

The Straits Settlements have an R.N.V.R. Division which in peace time was trained in the old sloop H.M.S. *Laburnum* and in four motor patrol boats. Kenya and Zanzibar employed two minesweepers of the tug type for training their R.N.V.R. personnel. Other British colonies which started R.N.V.R. units before the Second World War are Hong Kong, where drill was carried out in H.M.S. *Cornflower*, an old sloop; Gambia, Sierra Leone and Gold Coast, in Africa; Ceylon, Bermuda and Mombasa.



H.M.C.S. SKEENA, A MODERN CANADIAN DESTROYER

This Canadian destroyer has a displacement of 1,337 tons, a main armament of four 4.7-in. guns and eight 21-in. torpedo tubes. Ships of this class have been specially strengthened to withstand ice pressure. Their speed is over thirty-seven knots and their normal complement is 138

Of the value of such volunteer personnel there can be no question; indeed, it now forms a very large proportion of the Navy as a whole. An inspiring example is afforded by the magnificent fight made by the little river gunboat H.M.S. *Petrel* at Shanghai against the big Japanese coast defence ship *Idzumo* on December 7, 1941. Though there was no hope of survival, her captain maintained the highest traditions of the Royal Navy in refusing to surrender. He was a temporary officer in the R.N.V.R.—Lieutenant-Commander Polkinghorne, who had formerly been a North China river pilot

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CREW OF A TRAWLER-MINESWEEPER AT GUNNERY PRACTICE

All merchant ships now carry guns as a protection against aerial and submarine attack. Good gunnery has saved many British minesweepers, especially from attacks from the air

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CHAPTER 17

The Merchant Navy in Wartime

Transition from peace to war. A trading concern. Preparation for conflict. Personnel. Royal Naval Reserve. Training for Mercantile Marine. Terms of service. Pay and allowances. Liners as armed cruisers. Unarmed "Athenia" attacked. Convoy station-keeping. Dunkirk. Sinking of H.M.S. Rawalpindi. The fighting H.M.S. Jervis Bay

UNDER war conditions the Royal Navy and the Merchant Navy are complementary national services. In the course of a war the Merchant Navy, when the ships have been provided with defensive guns and gun crews, becomes also a fighting force which is of high value; but the transition from peace to war status is necessarily slow. Great strides were made in the Second World War in developing these merchant fleets for their own defence. This, in some degree, relieved the Royal Navy.

WAR AND PEACE FLEETS

The Royal Navy is the Navy of Defence—as well as of Offence—and is a State organization. Money for its maintenance is voted each year by Parliament and is supplied by the Treasury by means of taxation. This force consists of men-of-war specially designed and built for the contest of violence organized by man. All the surface craft are protected from enemy action not only by their armament —16-in. guns and guns of lower calibre, as well as torpedoes—but, in the case of battleships and cruisers, by armour on the decks and sides in places as much as sixteen inches thick, and these are also provided with bulges; while destroyers have high speed, and submarines the ability to submerge.

The Merchant Navy—the Navy of Supply—is not constituted for the purposes of war. It is like any other industry, such as coal, cotton or steel, in that the capital, represented by the ships, is provided *not by the State* but by private investors who receive any profits which may be made and pay any losses which may be incurred. In a recent good year merchant shipping earned gross freights in overseas trading which amounted to £340,000,000, with which food and raw materials were bought overseas for this country's use. The Merchant Navy is a national asset, a trading concern competing with the merchant shipping of other countries and helping to balance the national trading account of the British people—a people more dependent on outside supplies of food and raw materials than the people of any other country.

UNARMED MERCHANTMEN

The ships of the Merchant Navy are built for peaceful trading and not for fighting. The main structures of the hulls are covered with plates less than half an inch thick, except the largest liners whose plates are as much as 0.62 inch thick amidships, but only 0.42 inch at the two ends. Though well fitted to withstand the violence of Nature, in accordance with the regulations of the classification societies (foremost among them, Lloyd's Register of Shipping), such ships are unsuited to oppose the violence of man, armed with guns, torpedoes and bombs.

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Yet they have to meet enemy attack in time of war, whether they are used as armed merchant cruisers, as army transports, as store-ships in attendance on the fighting services, as oil tankers, or as hospital ships. Nor is even the ordinary cargo carrier immune from attack.

PROTECTING MERCHANTMEN

On the outbreak of the Second World War the whole Merchant Navy, including passenger liners, intermediate liners—that is, large ships carrying a great deal of cargo and a relatively small number of passengers—cargo liners proper, deep sea tramps, short sea traders as well as oil tankers, looks to the Royal Navy for protection from the enemy. But the Royal Navy cannot be always present when a surface raider, U-boat or bombing aeroplane appears. So it has become the modern practice to provide all cargo-carrying ships, as well as oil tankers, with some defensive armament. But the ultimate means of defence of all these vessels, while operating on the trade routes, are the battle fleets. The battleships, with their scouting cruisers, aircraft carriers and destroyers, are the supreme embodiment of force for the safeguarding of merchant shipping.

During the interval between the close of the war of 1914-18 and the opening of hostilities in the autumn of 1939, the Admiralty had this problem of the duties of the Merchant Navy in time of war under constant consideration. It was realized that, on an emergency arising, it would be necessary to commission immediately a number of ships as armed cruisers. These would assume an offensive rather than a defensive role, some to assist in maintaining the blockade, others to undertake the duty of escorting convoys of ordinary cargo ships.

The naval authorities, therefore, arranged that a number of the larger passenger ships in course of construction should be "stiffened," so as to bear the strain of the armament which they would mount, and to store conveniently the necessary guns and ammunition. As the war clouds darkened in the years 1937-39, the Admiralty also insisted that a number of other passenger vessels, as well as large cargo carriers and oil tankers, should be stiffened, to enable them to take gun mountings for defensive armament as well as paravane gear. Shipbuilders generally were also asked to send to the Admiralty the general plans and other particulars of all sea-going vessels which they were building.

Apart from the differences in the character of (*a*) men-of-war, supported by the State, and (*b*) merchant ships, provided by the private investor, the two forces are quite dissimilar from the point of view of the personnel. Officers and men of the Royal Navy are trained from their boyhood upwards in war duties and are subject to the Naval Discipline Act. On the other hand, the personnel of the Merchant Navy is maintained for the purposes of transporting passengers or goods by sea under ordinary peace time competitive commercial conditions.

TRAINING OF OFFICERS

A large proportion of the merchant officers come from special training establishments, H.M.S. *Worcester* and *Conway*, and from the famous Nautical College at Pangbourne. After preliminary training, it is the pride of most of them to join the Royal Naval Reserve. Others come from the public schools and other sources, and only a minority of these join the R.N.R. As to the men, there is no regular system of entry. Under peace conditions youths can join the Merchant Navy without continuity of service; they sign on for a particular voyage and are then paid off. In the early stages of the war which opened in 1939, continuity of service was introduced and will probably be retained

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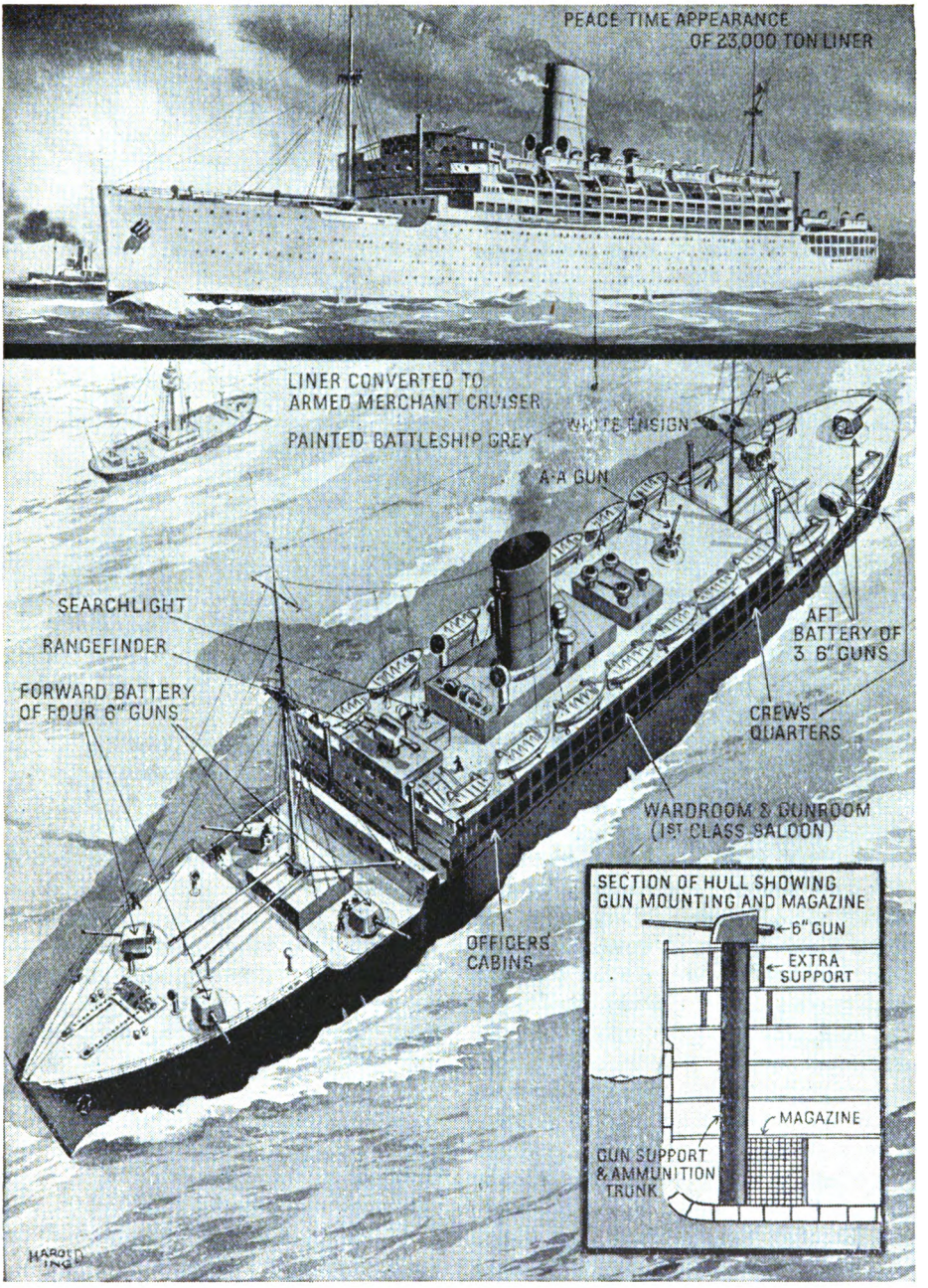

CONVERTING LINERS INTO ARMED MERCHANT CRUISERS

In wartime many merchant passenger liners are converted into armed cruisers. The usual gun positions on a merchant cruiser are shown above and (inset) the steel support for the gun

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under peace conditions; a "pool" was also established from which, under the compulsory system, seamen and others could be drawn for any ship as required. A relatively small number of men of the lower deck joined the R.N. Reserve.

EXPENDITURE ON R.N.R.

In relation to the aggregate sum spent on naval defence, the amount devoted to the reserves has always been very small. It only rose in the twenty years of peace—1919-1939—from £334,151 to £472,000; from this figure the weakness of this branch of the naval service can be judged. Out of this small expenditure the Admiralty paid retainers and allowances to officers and men, and also provided pay for officers who carried out the necessary training in the Royal Navy. Men of the various ratings were also entered for general or patrol service and, on completion of their second period of training, were selected for qualifying in gunnery, torpedo or other branches.

Some 46,000 reservists of all classes were called up when the Navy was mobilized in the autumn of 1939. Of these, 15,500 were men who had served in the Royal Navy for twenty-two years and then retired on pension. The next largest class, 11,000, belonged to the Royal Fleet Reserve, short service ratings who had served for between five and twelve years before joining the R.F.R.

The R.N.R. provided only 4,500, the maximum number which it was considered could be taken from the Merchant Navy without dislocating essential shipping services. The R.N.V.R. provided 5,000, and the remainder came from the R.N.R. Patrol Section, R.N.V.R. Wireless Reserve, the Auxiliary Sick Berth Reserve, and pensioners and reservists of the Royal Marines. Of the total of 46,000, some 5,800 were exempted for varying periods up to six months, or in some cases permanently on good grounds.

In relation to the great body of merchant seamen, the number of officers and men who were able to fit themselves for war duties was small. That was not the only weakness of the Merchant Service. On the plea of economy, the personnel of the Royal Navy had been greatly reduced. From the high water mark of 406,977 (1917), it had been brought down to 99,107 (1923). The increase, in subsequent years, was inappreciable in contrast with the larger shipbuilding programmes which were undertaken.

When war occurs, the Royal Navy, being subject to political control, is always short of officers and men and has to borrow from the Merchant Navy. But, since the beginning of the present century, the number of officers and men under the Red Ensign has steadily decreased. In times of shipping depression there is a surplus of both; but as soon as high freights or a national emergency make a call on every vessel afloat, a shortage is revealed at the very moment when the naval authorities are in urgent need of both officers and men.

DECLINE IN NUMBERS

The extent to which the number of merchant seamen, in particular, had declined was not brought home to the naval authorities until they had to mobilize the whole of the defensive forces to protect the sea routes in September, 1939. It was then discovered that the numbers of merchant seamen known to the Registrar General of Seamen had fallen by nearly 50,000 in twenty years, while there were about one-third fewer officers. But the demands of the Royal Navy were paramount over all others if the blockade was to be strictly enforced and escort duties satisfactorily carried out.

The Merchant Navy, with its officers members of various associations intent on improving their conditions, and its ratings belonging to trade unions, always enters

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on a war under many handicaps. These arise not only from the construction of the ships but from the lack of training of the majority of the officers and men. In face of many difficulties the Admiralty endeavours to supply these deficiencies; arranging, as has been stated, for the stiffening of the hulls of the more important ships, and for short courses of training for officers and men. The former are given instruction in the use of the defensive armament and in station-keeping in convoy, and the men in the use of defensive armament. By such means efforts are made to overcome to some extent the disadvantages under which a commercial force, such as the Merchant Navy, suffers when war occurs.

After the outbreak of war in the autumn of 1939, great attention was paid by the Admiralty to the gunnery training of the gun crews in the Merchant Navy. In fact, a separate department was formed to ensure that, as far as possible, the maximum offensive power was given to the armament of the ships. This policy bore ample fruit, as the reduction in losses of ships was in no small degree due to the care and foresight of the Admiralty in these matters.

The complementary functions of the Merchant Navy when the Royal Navy is mobilized for war are now fully recognized. The shipping companies, as a matter of course, hand over their ships to the management of the State and place their world-wide organizations at its service. They receive only five per cent interest on their capital, with an additional five per cent to provide for the depreciation of their vessels. The personnel of the merchant ships also automatically passes under the ultimate control of the Ministry of War Transport, which meets the demands made by the Admiralty, and proceeds, with the aid of

TRAINING MERCHANT SEAMEN IN GUNNERY

Unrestricted submarine and aerial warfare have made it imperative to arm as many merchant ships as possible. Consequently the training of merchant seamen in gunnery is a matter of great importance. Many enemy aircraft and submarines have been destroyed by the Merchant Navy

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UNLOADING LIGHTERS IN LONDON DOCKS

The men of the Merchant Navy bring the vital supplies to Britain whatever the difficulties. When convoys come into port, ships are rapidly unloaded in order that they again put to sea

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the naval authorities, to recruit additional officers and ratings for the merchant service. It is an indication of the sea sense of the youth of the country that, under war conditions, the number of young men who desire, under the National Service Act, to enter the Royal Navy considerably exceeds the needs of the Admiralty.

WARTIME RECRUITING

Arrangements were made to meet this condition of affairs after the war opened in September, 1939. The Admiralty agreed to train for service as merchant seamen a certain number of men from each age-group, who had expressed a naval preference. Within the numbers required, men who could not be accepted for the Navy and who were considered suitable, were asked whether they were willing to be trained for service in the Mercantile Marine as an alternative to being posted automatically to the Army. Those accepting this offer were entered in the Navy and ceased to be liable to be called up for the Army. When a period of preliminary training was over and the time came for them to be transferred to service in the Mercantile Marine, they were posted to an unpaid Reserve of the Royal Navy. As members of this reserve, they were liable for naval service if and when called up; but, as a rule, they were required to do at least two years' service as seamen in the Mercantile Marine before any question of their serving in the Royal Navy arose.

It was laid down that "men who cease to serve in the Mercantile Marine (except for short periods between engagements) will be liable, if the Admiralty so decide, to be discharged from the naval reserve; if so discharged, they will again become liable to the provisions of the National Service (Armed Forces) Act and available to be posted to the Army."

During their period of training in the Royal Navy, men entered under this scheme were paid as ordinary seamen ratings (two shillings a day plus sixpence war bonus) and were eligible for marriage and dependants' allowances under the same rules as other naval ratings. They were given naval uniforms and were accommodated and fed at the public expense. While awaiting appointment to a merchant ship on completion of their training, they continued to draw their former naval pay and allowances (including an allowance for food and lodging, if they were not accommodated and victualled in kind).

When appointed to a merchant ship they ceased to be eligible for any pay or allowances from the Royal Navy; and during sea service in the Mercantile Marine they were treated exactly as were other merchant seamen with regard to pay (it coming from the owners of the ships) and conditions of employment. During periods of unemployment between engagements on merchant ships they did not draw pay but were eligible for unemployment benefit under the normal regulations.

Men who were elected after two years' service in the Mercantile Marine to transfer to the Royal Navy, on completion of the normal period of the Articles of the merchant ship in which they were serving at the time, rejoined the Royal Navy as ordinary seamen for a short period of technical training. They were then drafted to sea as able seamen, when they again became eligible for marriage and dependants' allowances, as they were during the original period of training.

RATES OF PAY

As to pay, men who passed the Admiralty examination at the end of the period of training were regarded as senior ordinary seamen and received the National Maritime Board's rates of pay for the rating; this, in 1941, was £7. 7s. 6d. per month plus £5 war risk money. But

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in order to bring the wages of British crews into line with those of Allied crews, the National Maritime Board agreed that as a temporary measure an additional £2 a month differential money should be paid. After six months' sea service they were, if favourably reported on by the master, regarded as able seamen and received pay of £10. 10s. 6d. per month, plus £5 war risk money as well as the additional temporary allowance.

BASIS FOR THE FUTURE

This scheme (the details of which it is unnecessary to recapitulate) represented a further stage in the recognition of the Merchant Navy as a national service in time of war. It will no doubt serve as a guide in the future. It will assure to the men of the merchant service, when confronting an enemy, conditions as to training, service and pay commensurate with the duties they perform and the risks which they incur, in ships which were never intended for the violence of war under modern conditions.

The success of an enemy in attacking merchant shipping—necessarily at the opening of a war without guns or gun crews—lies in surprise, in instant readiness for action, as was illustrated when within a few hours of the outbreak of the Second World War, the liner *Athenia* was attacked. She had a full complement of passengers, was unarmed, had on board no munitions, was manned by ordinary mercantile officers and men—and, of course, fell an easy prey to the enemy.

Within a short time of the outbreak of a war the Admiralty requisitions all the merchantmen suitable for duty as armed cruisers, while other ships are taken up for escort duties. At the same time officers and men are required for mine sweeping, though the majority of these crews are drawn from the fishing population. When all these requirements have been met the merchant ships remaining, whether seagoing, short sea traders or coastal, are necessarily under many handicaps as soon as the task of organizing convoys is undertaken. For one thing, most of them are slow, and the slowest ship fixes the approximate speed of a convoy.

Again, watch-keeping officers are accustomed to sail independently. They have in war to conform to station-keeping under the orders of a naval officer in charge of anything from thirty to seventy merchant vessels; and at night time ordinary navigation lights are not permissible to assist them in avoiding collisions. They, as well as the look-outs, have to "keep their eyes skinned" for the approach of submarines on or under the surface, as well as the swooping down from the clouds of aeroplanes with their destructive bombs.

When the war of 1914-18 closed, there were upwards of 3,800 small craft in the Auxiliary Patrol. But, under the pressure of economy, that force had been reduced to a skeleton. It was a matter of some considerable time before it could be recreated. But the naval authorities refused to be defeated by the neglect of the years of peace. They rapidly provided and manned an ever-increasing force, drawing, of course, on the Merchant Navy.

RENEWAL OF FORETHOUGHT

As a result of their foresight in organizing merchant ships, yachts, small boats of all descriptions and even tugs, they were responsible for the miracle of Dunkirk. Here, under the protection of the Royal Navy, the main body of the British Expeditionary Force, 337,131 officers and men, were rescued from the beaches. It was a superb instance of co-operation of the naval and air forces, merchant seamen and amateur seamen of all classes. The brunt of the ordeal was borne by the officers and men of the Merchant Navy.

The majority of the vessels of the Merchant Navy remain on the *defensive*

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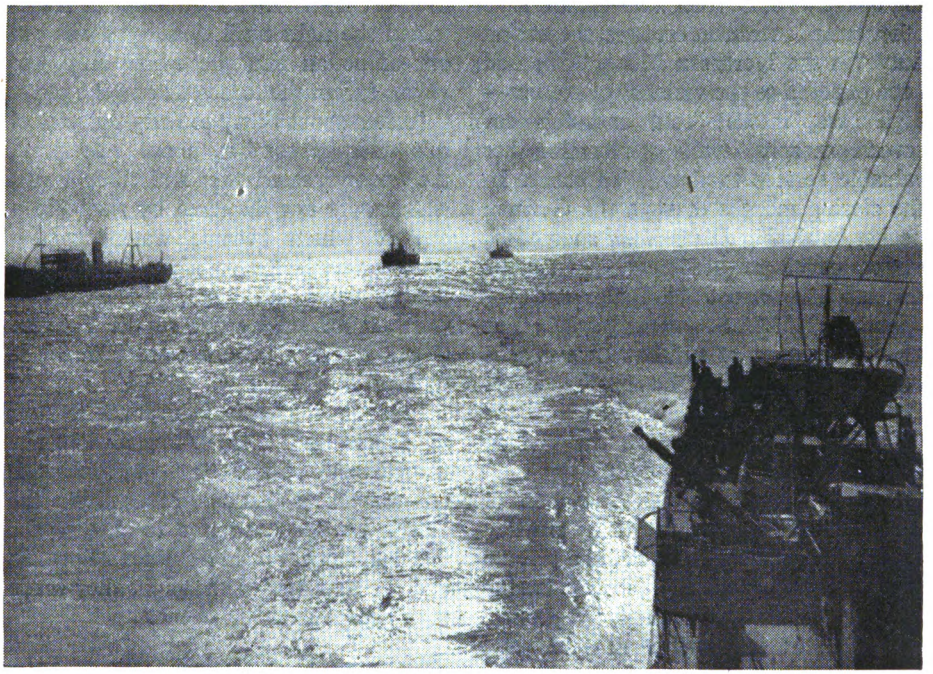
while carrying their cargoes or privileged passengers—Ministers and Government officials. They are armed only with guns of small calibre mounted aft, and are provided with depth charges. Some of them have aeroplanes which are catapulted off their decks when the alarm of "enemy aircraft approaching" is given. But the large passenger liners of the leading shipping companies which are taken over by the Admiralty as armed cruisers or escort ships have to play an *offensive* role. Their crews know, nevertheless, that there is only a fraction of an inch of steel between them and death when they come across a converted raider, or a man-of-war or a U-boat of the enemy.

These armed merchant cruisers, moreover, mount not 16-in., 13.5-in., 12-in., 9.2-in. or even 7.5-in. guns but weapons of only 6-in. calibre. Their ammunition, too, is a source of danger when they run into a minefield—because of the absence of deck and side armour—and when they are engaged by an enemy raider or U-boat. Owing to the development of enemy tactics in attacking merchant ships, some of our larger ships were fitted to carry aircraft for use in bad weather.

Armed merchant cruisers, whether engaged in escorting convoys of cargo ships or in supporting the blockade of the Royal Navy, pass under the White Ensign. They are commanded by naval officers, and their gun crews are ratings of the Royal Navy or the R.N.R.; but most of the crews are generally Royal Naval Reservists or mercantile ratings.



BRITISH CONVOY BRINGING IN SUPPLIES

In order to avoid delay in making the sea passage, separate convoys are as far as possible arranged for fast and slow ships. All of these convoys are protected by warships

Within twenty-one years of the signing of the Armistice on November 11, 1918, Germany, with an army and air force more powerful than any country had

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hitherto possessed, entered upon a new war of aggression. The Admiralty had once more to call the great liners from their peaceful voyages that they might be armed as merchant cruisers. And again events showed that such vessels of frail construction might have to fight enemy ships of much superior power.

GALLANT "RAWALPINDI"

The first incident was that of the sinking of the P. & O. liner *Rawalpindi*. Like other armed merchant cruisers, she was on duty "in the Northern Mists." She had been exposed to the violence of Nature—high seas, intense cold and fog—for several months, while performing her valuable service to the Allied cause. In the closing months of 1939 the German pocket battleship *Deutschland* succeeded, under cover of darkness, in getting through the British blockade, and encountered H.M.S. *Rawalpindi*. The official narrative of subsequent events is eloquent testimony to the gallantry of the British seamen, those covenanted to the State and those who were the civilian servants of the shipping company:

"At 3.30 p.m. on the afternoon of Thursday, November 23, when cruising to the south-east of Iceland, she sighted an enemy ship. Captain Kennedy, having observed this vessel through his glasses, said: 'It's the *Deutschland* all right!' and the crew were immediately ordered to action stations. Course was altered to bring the enemy on the starboard quarter. Smoke floats were lit and cast into the water to enable H.M.S. *Rawalpindi* to escape. However, a second enemy was soon seen to starboard.

"The *Deutschland*, approaching, signalled to H.M.S. *Rawalpindi* to stop, and when she continued her course the enemy fired a shot across her bows. As this warning was rejected, the first salvo was fired by the 11-in. guns of the *Deutschland* at a range of 10,000 yards. H.M.S. *Rawalpindi* replied with all her four starboard 6-in. guns. The third salvo from the *Deutschland* put out all the lights and broke the electric winches of the ammunition supply. The fourth salvo shot away the whole of the bridge and destroyed the wireless room.

"Both the German ships were now closing rapidly, and by this time the second ship had gone round H.M.S. *Rawalpindi's* stern and was firing from the port side. H.M.S. *Rawalpindi* maintained the fight until every gun was put out of action and the whole ship was ablaze except the forecastle and the poop.

"After about thirty to forty minutes of this unequal combat, about 4.20 p.m., the enemy ceased fire; and three boats, which were not shattered by shell-fire—one of which became water-logged—were lowered. Two of these boats, containing thirty survivors, it is believed, were picked up by one of the German ships. Eleven survivors were brought in by H.M.S. *Chitral*.

"H.M.S. *Rawalpindi* continued to burn amidships until eight o'clock, when she turned turtle to starboard and sank with all remaining hands. Meanwhile the British cruiser attempted to shadow the German ships, but in a sudden rainstorm and the darkness of the night they made their escape from the scene."

TRADITION OF MERCHANT NAVY

In tempestuous seas and darkness of night, the search for the enemy men-of-war was continued; but they managed to escape. Though toll was not immediately taken of the enemy, the traditions of the Royal Navy and of the Merchant Navy were enriched by an epic example of how men under the White and Red Ensigns fight against heavy odds—to the death.

Another story illustrating how British seamen will court death in pursuit of duty was furnished in the same month when news came in from the sea of how

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Captain F. S. F. Fegan had opposed the weakness of his ship, H.M.S. *Jervis Bay*, constructed for peaceful trading, to the overwhelming fire of the enemy.

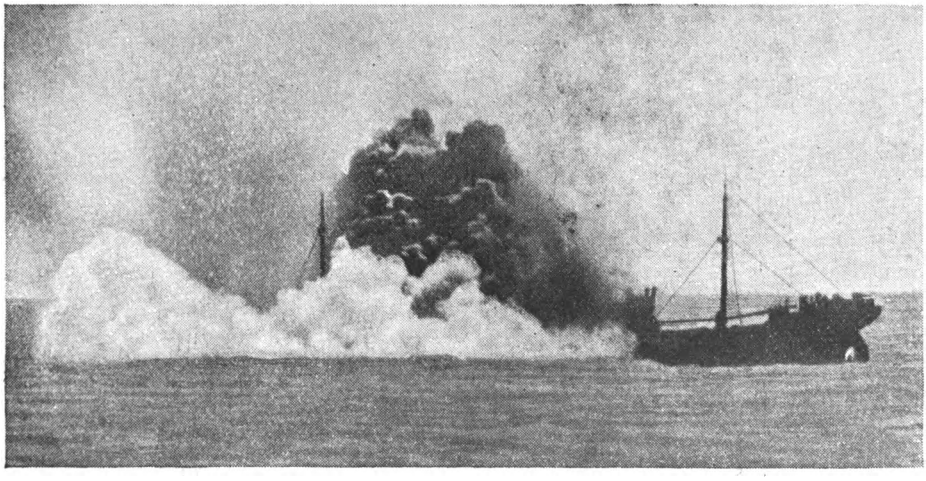
On November 5, 1940, H.M.S. *Jervis Bay* was escorting a convoy of thirty-eight merchant ships in the Atlantic when she was suddenly challenged by a German battleship, believed to have been the *Scharnhorst*. She might have awaited the coming of her more heavily armed and well armoured opponent. But, on the contrary, in order to give her convoy a longer time in which to scatter and try to escape, she turned towards the German ship and, as she closed, fired the few guns of low calibre—only 6-in. weapons—which she mounted. The contest began an hour before dusk, and therefore in failing light. It is doubtful if, at any time, H.M.S. *Jervis Bay* got within effective range of the enemy battleship before she was herself mortally wounded by a well-directed 11-in. shell. Some accounts state that the third salvo from the German battleship hit her. At any rate, H.M.S. *Jervis Bay* was soon disabled and set on fire. But she continued to engage the enemy for an hour before she sank.

In the meantime Rear-Admiral Maltby—the acting commodore of the convoy—ordered the merchant ships to turn to starboard, drop their smoke floats and scatter. The ships on the port wing column fired their small defensive guns, but the shells inevitably fell short.

POSTHUMOUS AWARD

The daring of Captain Fegan (awarded posthumously the Victoria Cross) was successful. Eight-ninths of the convoy, thanks to his intrepid action, escaped from the enemy and reached port with their cargoes.

It is small wonder that naval officers of all ranks and ratings lift their hands in salute to the men of the Merchant Navy who, fighting against heavy odds—big guns of enemy battleships or cruisers, skilfully converted ocean raiders, U-boats or bombing aeroplanes—carry on with unflinching courage, maintaining the high traditions handed down to them by such as Drake, Hawkins and Raleigh.



BRITISH MERCHANTMAN TORPEDOED BY THE ENEMY

This picture, taken from an enemy ship, shows a British ship sinking after a German torpedo has struck her. It was to minimise such occurrences that the convoy system was adopted, and to reduce the losses of our merchantmen has become one of the chief duties of the Navy

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DUNKIRK MEN COME HOME ON BRITISH DESTROYERS

During the evacuation from Dunkirk the ships were constantly attacked by dive bombers, but the warships and the R.A.F. fighter planes greatly reduced serious loss of life. More than 300,000 men were successfully evacuated from the beaches in all types of ships

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CHAPTER 18

Amphibious Warfare

Duties of the Navy and of the Army. Principles of landing operations. Effect of British sea power on Italy's empire, and on Iraq. Japanese amphibious operations. Fast merchant ships. Commandos. Vaagso raid. The Navy's task at Tobruk. Greece. Crete. Dunkirk.

EVERY campaign that the British Army throughout its history has undertaken, since the invasion which ended with the Battle of Hastings, has been fought overseas. This is still the case. Any military operations that this country undertakes are therefore primarily dependent upon sea power and upon the efforts and exertions of the Royal Navy.

In wartime the Navy's chief duty is to keep the passage of the seas clear for the transport of troops and material from this island to wherever they are needed. It also has to ensure that raw materials and food arrive in this country. No military operation of any size can hope for success unless the Power undertaking it has control of the seas between the scene of operations and its main base. So far as Britain is concerned this main base has hitherto been the United Kingdom.

The Army in its turn helps the Navy by holding the naval bases strung out across the world, without which our fleets and squadrons cannot operate. Shortly after the war of 1914-18 the writer met a German in Shanghai, who, in the course of conversation remarked: "After the voyage I have just made from Europe, can you wonder that there was a war between Germany and Britain? Every single port at which my liner stopped was British." He then rattled out the names—Gibraltar, Malta, Port Said, Aden, Colombo, and so on, right round the world. It is the function of the Army and Air Force to hold these bases; and, unless they are securely held, British sea power would be sorely handicapped.

There are certain cardinal principles regarding the landing of an army on foreign soil. To do this *four* things are essential: (1) The Navy must have complete control of the surface of the transport route. (2) It must also have mastery, if not complete control, of the sea below its surface. (3) There must be complete control of the air over the transport route, over the place of disembarkation and over the adjacent territory. (4) There must be available a harbour with facilities for lifting the heaviest weights that the Army may wish to transport, and ample jetty space for rapidly landing the men.

SCORCHED EARTH POLICY

It must also be remembered that if a landing is made on enemy territory he will have pursued a "scorched earth" policy to the extent of removing all locomotives and rolling stock. This will have to be replaced from home stocks at considerable loss of manufacturing time and transport tonnage. To land in France in 1939 was simple for the British, since all the above four conditions were fulfilled. To have landed in November, 1941, would have been an impossibility.

The Second World War has stressed the truth of these basic facts. For example,

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EVACUATING BRITISH WOUNDED FROM TOBRUK

The small ships of the Royal Navy have played a leading part in the defence of Tobruk. Here British wounded are seen going aboard the captured Italian hospital ship, "Ramb IV"

when the French Army was *in extremis*, Mussolini and his advisers firmly believed that England also would collapse. Gambling on this hope, they chose to discount the full importance of the possibility that should England persist in the struggle, their forces in Abyssinia, Italian East Africa and Libya would be completely cut off from their home base. Unless Italy could seize command of the waters of the Central Mediterranean or of the long sea route via the Cape of Good Hope, their position would become one of great gravity. This disregard of sea power led to a hasty declaration of war against the British Empire and, in the end, to the loss by Italy of her newly created African Empire.

Britain, however, continued the struggle and freely passed troops, materials, reinforcements and supplies by sea from home and from South Africa to attack the isolated Italian Empire. It detracts nothing from the brilliant operations of the British and African troops in Abyssinia and Eritrea to say that the eventual success of these campaigns was determined by sea power. It was, in the last instance, due to the control by the Royal Navy of the sea both inside and outside the Mediterranean.

Unchallenged command of the sea also helped the suppression of the rebellion in Iraq. At the time this broke out, Britain had very heavy commitments in Libya and Abyssinia; moreover, at all costs the Nile Valley had to be protected. Furthermore, time was an essential factor, but instead of having to transport troops by the long and arduous journey overland from Egypt to Iraq, sea power enabled us to send a force direct from India up

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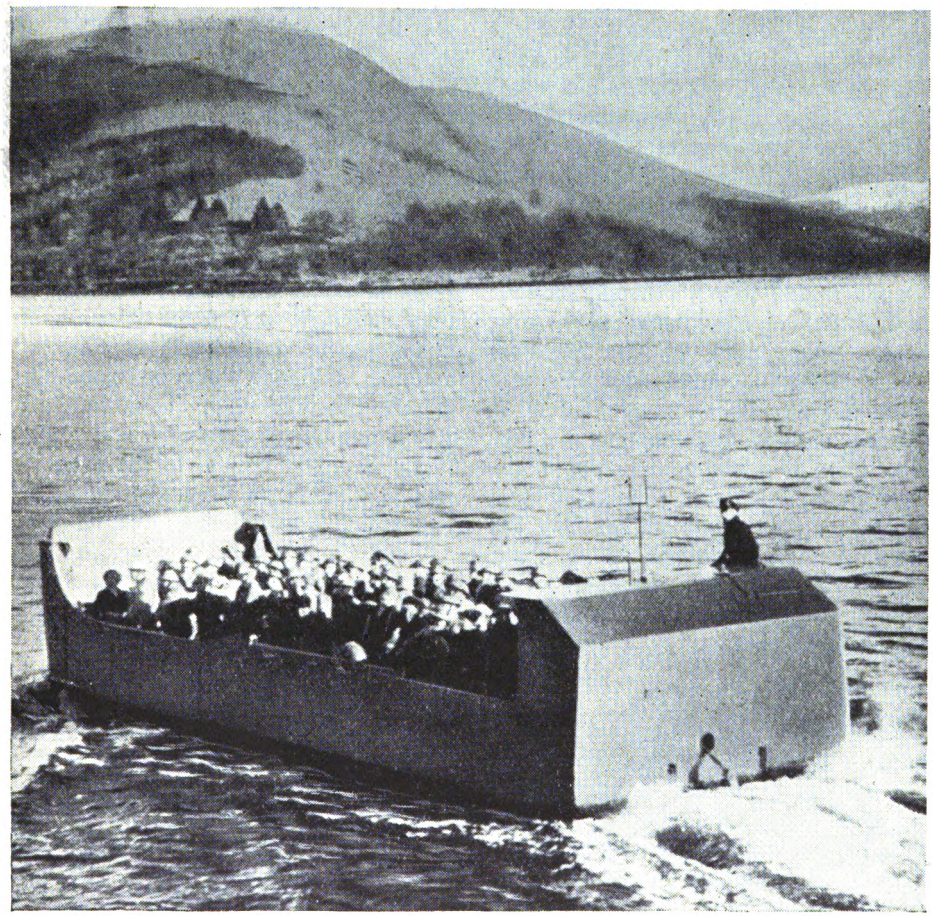
the Persian Gulf to Basra. While this force was dealing with the situation in Iraq, the Axis High Command in Berlin, being unable to transport troops by sea or to prevent our doing so, could only watch impotently while their schemes for a rising over the whole of the Near East were being frustrated.

It is well here to remark on the uses of primary and secondary bases. The harbours of the Motherland, or those of an ally who is able to supply all kinds of warlike stores and which afford protection to ships while undergoing repair or refuelling, may be looked on as primary bases. Other bases vary in importance according to the shelter they can afford, and their capacity to store and supply munitions, and their distance from the theatre of the war. For instance, the harbours of Great Britain are her main bases: Gibraltar, Malta and Alexandria are secondary bases for her fleet stationed in the Mediterranean. The well-equipped



BRITISH TROOPS GOING ASHORE ON THE LOFOTEN ISLANDS

The Royal Navy convoyed the troops to their objective. The Royal Air Force kept enemy aircraft away, while the troops carried out their work. This party is going ashore in a specially designed landing barge carried in the big ships and hoisted out when near land

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harbours of the dominions and colonies form secondary bases for wars being carried out in waters adjacent to them.

The dream of the Japanese has for years been the seizure of the Malayan Peninsula and the islands in the South-west Pacific. Japan, however, was over 2,500 miles from such a theatre of operations; a distance far too great at which to carry on active sea operations. Her opportunity, however, came when she joined the Axis and induced Germany to bring pressure on the treacherous Vichy Government to hand over to her the whole of Indo-China. Thus she obtained a strong secondary base close to the waters which surrounded the islands she coveted. Aerodromes, and large areas in which to collect troops, came with this concession; and, immediately, she proceeded to make full use of her opportunities.

The ticklish political position in the United States, where a strong anti-war feeling existed, prohibited any strong action being taken by the President which might have been construed as a threat to Japan. Britain's commitments in Europe rendered her impotent to interfere. Thus by a fatal combination of circumstances, Japan was able, undisturbed, in peace time to establish her fleet and army close to her proposed theatre of war. Her active line of communications for the transport of troops had been reduced by at least 1,500 miles.

SEIZED BASES

She has since carried out a number of daring operations to increase the scope of her influence. She has seized bases for her ships and aircraft which have served as advanced positions for future operations in her steady progress southwards. As she spreads through the Pacific like a cancerous growth, the pattern of her advance shows that each attack is merely to gain a stepping-stone to something further on. But, although she can operate almost at will in that area of the world, she has not been able to use her sea power outside the Pacific and Indian Oceans, nor to affect the European situation.

Ever since the war of 1914-18, Japan has studied the problems of combined operations in the South-west Pacific. Moreover, she has done more than merely make a study, she has made intense preparations. She needed fast transports and fast supply ships, and for years past she has been building up a fleet of 14-knot (or over) tankers and merchant vessels. These ships in times of peace are too expensive for private firms to build or operate. Their cost is great and their running costs are commercially prohibitive.

SUBSIDIZED SHIPS

But Japan, owing to Government subsidies, was able to build up a fleet of such merchant ships. The British Government could not subsidize her huge merchant navy to the same extent. It was content only to subsidize the two extremes, of luxury liners of 80,000 tons like the *Queen Mary* or *Queen Elizabeth*, and a number of 8-knot tramps. Japan knew what she wanted in the event of war in a restricted area and proceeded to get it. A luxury liner in time of peace may, if she becomes popular, pay her way and perhaps a little more; but in time of war, except for the transport of troops, she is very much a "white elephant." On account of her huge size, she is extremely vulnerable to torpedo or surface attack. She is not built for cargo-carrying, so has not the necessary storage capacity for carrying large amounts of military supplies. Whereas Britain had world-wide commitments, Japan built and planned for a special class of amphibious operations. No one could have foreseen the collapse of France and the treachery of the Vichy Government.

After the fall of France, formations known as Commandos were started;

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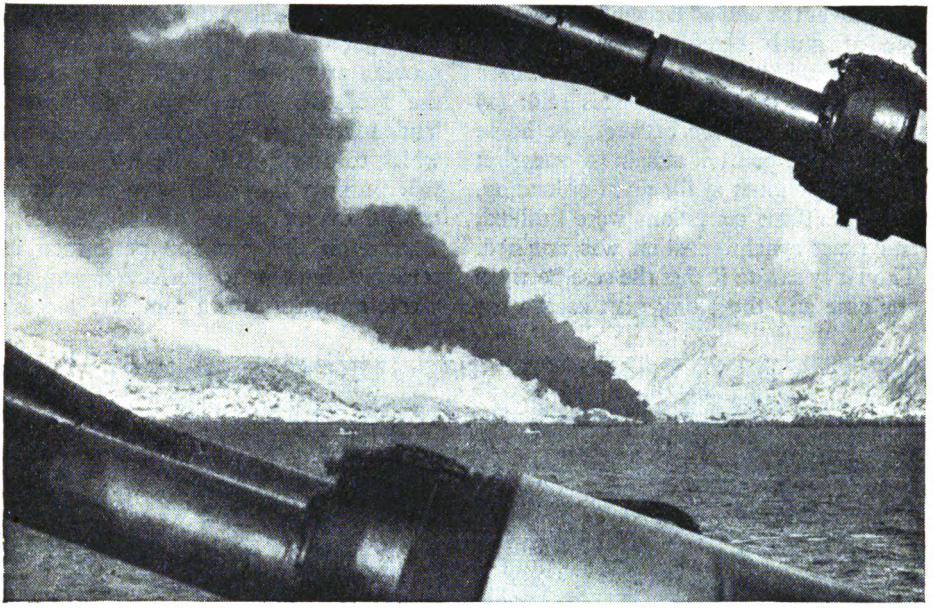

BRITISH COMMANDOS RAID THE LOFOTEN ISLANDS

A typical amphibious operation, very similar to the attack upon Vaagso, was the raid by British Commandos upon the enemy-occupied Lofoten Islands off the coast of Norway. Some 18,000 tons of German shipping was sunk, 200 prisoners taken, and over 300 Norwegian volunteers brought to Britain to serve against the enemy. This picture, taken from between the multiple pom-poms of a British escorting warship, shows the burning oil storage tanks

and, under the Director of Combined Operations, plans were made and some intensive training of small units was carried out. It was very early realized that the old idea of landing troops in a warship's boats was impracticable: special landing craft were needed. In the old days when the Marines were sent from a warship in the cutter or the pinnace to land on an enemy shore, that enemy was as often as not a few hostile natives armed with assegais or spears, and had no aircraft. A soldier in a ship is never at home; still less can he be expected to be efficient in a small open boat propelled by oars. Modern landing craft have been designed for small landings. They are flat-bottomed and draw very little water, so that they can get ashore easily; and in the bows there is a ramp over which the landing troops can pass quickly and easily, without having to scramble over an inconvenient gunwale. They are fast and propelled by reliable motors. All the plans for these, all their building and reconstruction, has had to be done in the middle of a war, which was taking practically every ounce of the nation's effort; but, in spite of that, the necessary craft have somehow been produced. Boatwork is always difficult, as any one who has ever taken a trip on the Serpentine or who has taken novices for a picnic in a punt on the backwaters of the Thames will know. In their training, therefore, the Commandos, as soldiers, had to be taught to be amphibious.

An almost perfect example of a small amphibious operation was the raid carried out on Vaagso Island on the coast of

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Norway at the end of December, 1941. It needed much careful planning as all three Services were involved. Three things were necessary for this raid: (1) Command of the sea between the home base and the point of attack; (2) surprise; (3) air superiority at the point of landing. All these three conditions were fulfilled, and exact synchronization was attained. The Navy saw to it that the seas between our base and the Norwegian coast were clear of superior enemy forces for the passage of the expedition. In a wintry and stormy North Sea, it is extremely difficult to be absolutely certain of a ship's position at any particular time; yet our surface forces approached an unlit, hostile enemy coast and arrived at their destination at exactly the right moment. Their arrival had to synchronize with a force of bombers, whose function was to bomb the defences and to drop smoke floats to cover a landing from the sea. At the same time, relays of fighters had to fly out right across the North Sea so as to provide protection for this force during the operation. The troops which were landed were given a certain time limit in which to obtain their objectives, and for this purpose they had been intensively trained over a period of months. Each Service on this occasion performed its separate function to perfection and the whole operation was a complete success.

SUNDERLAND FLYING-BOAT HELPS IN THE WITHDRAWAL FROM CRETE

The withdrawal from Crete was a difficult amphibious operation. British command of the sea alone made it possible. Even flying-boats helped small parties of men to escape, and, above, some men can be seen making their way in a small dinghy to a Sunderland flying boat

The forces landed were small and did not have to maintain themselves in enemy country : they were not required to form a bridge-head for a larger force to follow; no heavy artillery or tanks were required. A raid of greater magnitude would obviously be an immense undertaking. A vast amount of preparation, shipping, cranes, and heavy lifting devices would be required for the landing of a large expeditionary force. The difference between a mere tip-and-run raid, like that

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at Vaagso, and a serious invasion cannot be too strongly stressed.

These raids are useful practice for what may perhaps come later in the war; not impossibly, in a year or so, in the Far East. Each raid teaches its own lessons and gives experience in amphibious warfare under active service conditions, which was not, and could never have been, gained in peace time. They have also a certain nuisance value, besides any material damage they may do. On this, the Vaagso raid, H.M. ships were lucky enough to find a number of German-controlled merchantmen gathering to form a convoy, which would eventually have sailed to the north of Norway to replenish the German Army on the Murmansk front; these, of course, were sunk.

The German troops who are sparsely scattered on the immensely long, irregular coastline of Norway are not encouraged by the news that a number of their comrades were killed or taken away into captivity by a force which appeared without any warning out of the grey mists of the North Sea.

The cumulative value of such raids must undoubtedly have an adverse effect on the morale of the local troops; but they cannot affect the course of the war, except in so far as they annoy the Germans and throw a little sand into the works of their military machine.

PERILOUS TRANSPORT

The raids appeal to the public and make good reading in the Press, but they are not nearly so useful or perilous to carry out as the transport of even a small convoy through the Mediterranean.

None of these small raids approached in magnitude the Navy's task at Tobruk. Here a large body of troops had to be provided for eight months with ammunition, food and every form of supply. The garrison of Tobruk held the harbour—which is a very small one—and an area of the hinterland. All supplies had to be taken by sea along a hostile coast, where the ships carrying them were subject to incessant air attack. They were also in danger from submarine attack. Such was the moral ascendancy, however, achieved by Admiral Cunningham's Mediterranean Fleet over the Italians that, though the target was always there, it was untroubled by Italian surface craft.

NO FIGHTER PROTECTION

To overcome the danger from the air practically all these ferry trips had to be undertaken under cover of darkness, as the Air Force in Libya could not provide fighter protection. The ships undertaking these trips had, moreover, to be small enough and of sufficiently shallow draught to enter the tiny, wreck-infested harbour of Tobruk. All these eight months prisoners of war and wounded were removed and the garrison itself never ran short of any essential commodity: ammunition and food were always available.

Before Tobruk was finally relieved by the offensive in Libya, the entire garrison had been changed. Thirty-two thousand men had to be taken off from this port, which had none of the facilities which are usual for handling troops; and 32,000 others, as well as a great deal of new equipment including tanks, had been landed to replace them. The succouring and changing of the garrison at Tobruk was one of the greatest tasks that the Navy has been called upon to undertake in this war. It was a job for the "small ships." All the actual work fell to them, while their big sisters were either at Alexandria or patrolling at sea to provide cover for their operations. There was an urgency in every trip to Tobruk which caused a tremendous strain on the ships and crews, who were already overworked; and the commander-in-chief, Mediterranean, had to allocate for this

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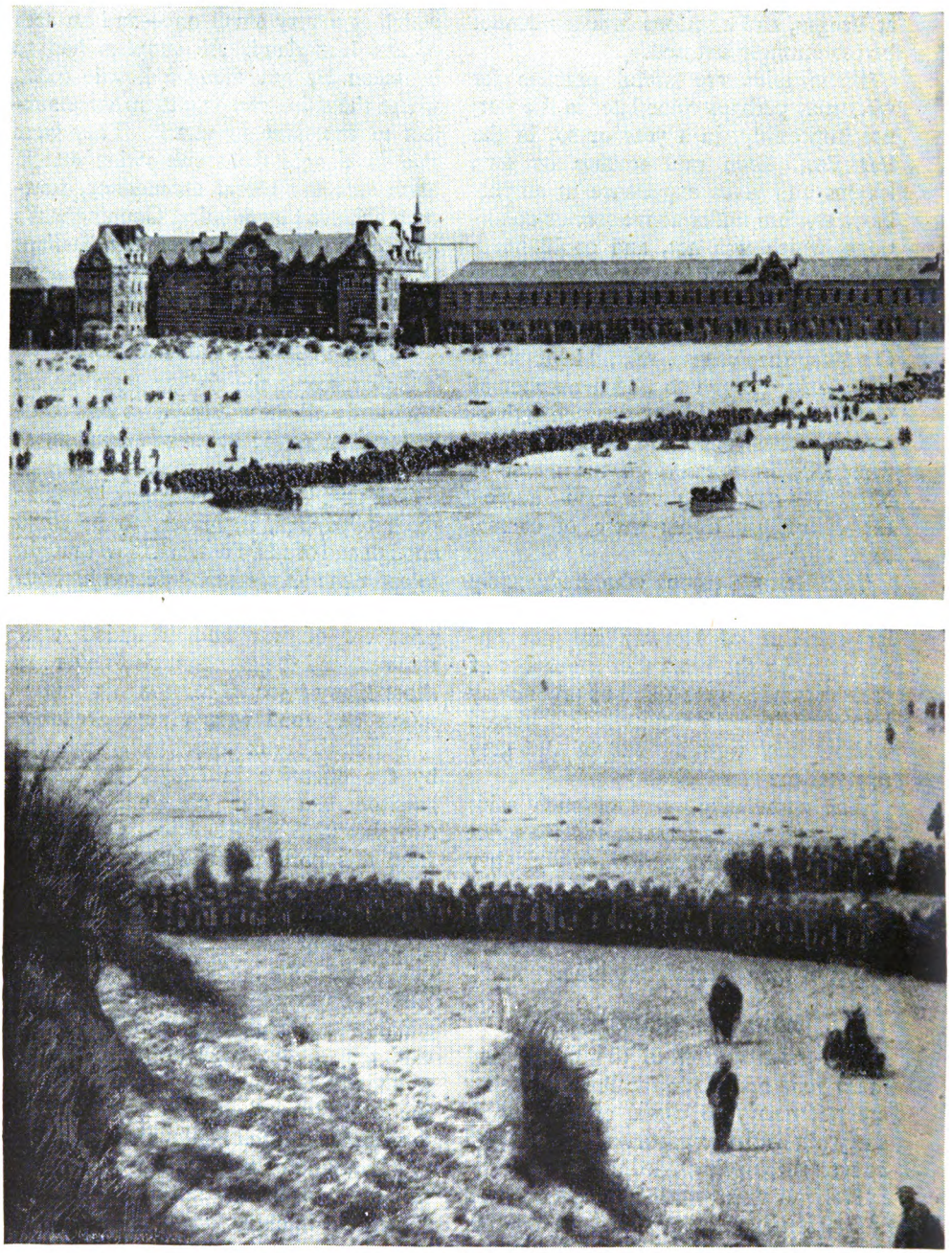

SCENES ON THE BEACH AT DUNKIRK AS

Between May 30 and June 3, 1940, over 330,000 men were evacuated from Dunkirk. Nearly 900 craft of every shape and size took part in this astounding combined operation.

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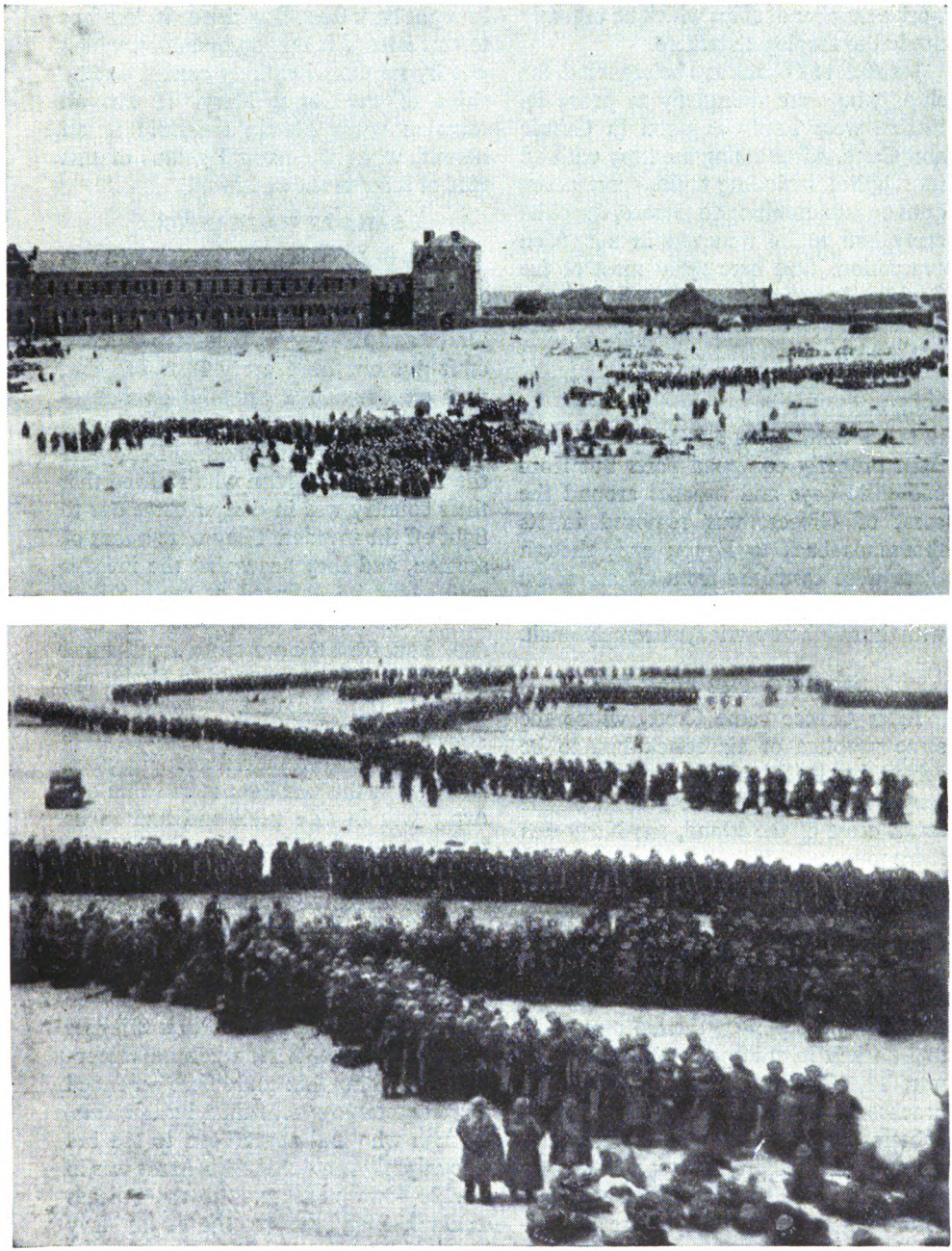

THE BRITISH TROOPS AWAITED RESCUE

(Above) Troops are wading out to the small boats, two of which can be seen in the foreground. (Below) Men are waiting on the beach before evacuation by this strange collection of ships

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work a number of ships which he urgently needed to employ elsewhere.

Just before Tobruk was beleaguered, the ships who were eventually to prove its lifeline were busily engaged in Greece and Crete. After taking an army with all its supplies, including tanks, spare parts, guns and ammunition to Greece, the same army had to be removed in a sudden evacuation. And here again most of the final loading of troops had to be done at night because of the lack of fighter aircraft to keep in check the enemy bombers operating over Greece. The heavy equipment had to be left behind; but the Army, in small contingents and in driblets, not from properly equipped ports but from odd little bays and beaches around the coast of Greece, was removed in its thousands back to Egypt; and, though there were casualties from air attack on the return journey, they were, compared with the numbers carried, extremely small.

BACK TO THE BEACHES

After Greece came Crete, where the same problem of air attack had to be solved by British ships. As the Army fought its way back to the beaches on the south coast of the island, the Navy was there to meet it. Under cover of darkness again, thousands more troops were brought away in safety. Neither in Greece nor Crete did the British have the assistance of hundreds of small local craft, as at Dunkirk, to help in the evacuation; practically every man carried away had to be taken in transports or in ships of war. They had to be removed from the beaches to the ships in small boats or lighters, or in the ships' boats; some even got away in Sunderland flying-boats.

But the greatest operation of this nature carried out so far in the Second World War by British seamen was the evacuation of the Army from Dunkirk. Altogether, including fit men, casualties and Allied troops, 337,131 men were brought back from Dunkirk or its beaches to this island. It was an operation which was by no means entirely carried out by ships of the Royal Navy. It was an occasion when Britain suddenly found herself, when the natural genius of this race of seamen showed itself.

SAILING UP-CHANNEL

When in 1588 the Spanish Armada was sailing slowly up the Channel and being harried by the Queen's ships under Drake and Effingham, hundreds of small craft put out from every little bay and port on the south coast—from Kingsbridge, Dartmouth, Brixham, Exmouth, Lyme Regis and Weymouth, Poole and the Isle of Wight. Men who realized that their country was in danger came out to fight off the invader. They were a race of seamen, and they knew that the invader could best be defeated at sea. So, in their little sloops and wherries, they darted out from the coast into the Channel to be what help they could to Drake and the Lord High Admiral.

Something of the same sort happened in England three hundred and fifty years later, when the word got round that our Army was in dire peril and had to be removed by sea. Ships of the Royal Navy were not sufficiently numerous to carry out this task; and, as no ports were available, the whole operation had to be improvised.

IMPROVISED RESCUE

Yachts of all sizes, lifeboats, Thames barges, river steamers, weekend motorboats, anything that could float—manned by volunteers, by yachtsmen, by amateurs, by men who had never been to sea but who vaguely knew that their Army was in trouble—swarmed across to the beaches at Dunkirk and assisted the Royal Navy in the largest impromptu combined operations the world has ever seen. Here again the Air Force helped, and by incredible exertions the fighter pilots

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BRITISH TROOPS WADING OUT TO A RESCUE SHIP AT DUNKIRK

Forming a human chain from shore to ship, the troops are here seen up to their necks in the sea. Ships of all types and sizes came in among the treacherous shoals to rescue them. By great heroism and skill, these ships carried out the greatest amphibious evacuation yet known

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RETURNING FROM A RAID ON SPITSBERGEN

Among the early British amphibious raids was that on the oil stores at Spitsbergen. The fuel tanks were destroyed and many rescued Norwegians were brought to Britain

managed to keep off the bombers from these dense lines and queues of men thronging the packed beaches of Dunkirk.

The whole episode was one of the finest examples of what men, who, deep down in their hearts feel the call of the sea, can do. Thousands of amateurs and ships of the Royal Navy worked, in perfect co-operation and yet independence, to achieve a success which in all probability saved this country. An officer who was one of the last to leave the beaches of Dunkirk with a party of soldiers has described how he and his few men managed to get hold of a motor-boat and make it function. He describes how on their way back to England they sighted a destroyer as they were approaching the mud flats of Essex. Immediately they saw it in the distance they assumed as a matter of course that it was British; the mere possibility of its being Boche never occurred to them, such was the reliance placed by the British upon the Royal Navy; "A reliance about which," remarks this officer, "little is said and very much taken for granted. But no account of the events at Dunkirk," he concludes, "would be complete without a reference to two factors which made the evacuation possible: one is the stout heart of the Royal Navy; the other is divine intervention, made manifest in the perfect weather and calm sea. And, if one puts one's trust in God and the Royal Navy, one cannot go far wrong."

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